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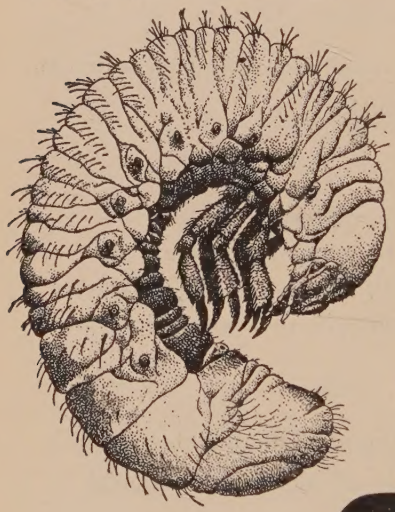

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Lodos (N.). **Süne'nin biyoloji ve mücadelesi.** [The Bionomics and Control of *Eurygaster integriceps* Put.]—*Türk Yüks. Zir. Mühend. Birl. Neşr.* no. 18, 57 pp., 21 figs., 2 maps, 24 refs. Ankara, 1953. *Eurygaster integriceps* **Put. Sa biologie et son traitement en Turquie.**—*Bull. Plant Prot.* no. 5 pp. 64–65. [Ankara] 1953.

In the first paper, the author gives maps showing the distribution of *Eurygaster integriceps* Put. in Europe and Asia and in Turkey, where the bug occurs over wide areas and is particularly injurious to cereals in the south-east. Observations on its bionomics in 1950–52 in this region showed that spring migration of the overwintered adults from the mountains [*cf. R.A.E.*, A **39** 141] begins in March, as soon as the snows melt, and continues intermittently until April. Migration was in the direction of the prevailing winds. The bugs settled in fields of young wheat and barley, on which they fed, and subsequently paired and oviposited. Oviposition continued until June, and the females laid about 70–80 eggs each in batches of 12–14, on both cultivated and wild plants. The nymphs hatched from May onwards, and adults of the new generation were present from the first week in June. They fed for a time on the ears and migrated to the mountains between mid-June and mid-July. Several natural enemies were observed, of which the most important were the Scelionid egg-parasites, *Microphanurus vassilievi* (Mayr) and *M. semistriatus* (Nees), the Tachinids, *Alophora subcoleoptrata* (L.) [*cf.* **41** 27] and *Phasia crassipennis* (F.), and the mite, *Balaustium miniatum* (Herm.), which attacks the eggs. Notes on the bionomics of these are included. Damage can be avoided to some extent by the sowing of early varieties and reduced by dusting cereal crops with parathion, which proved effective against the nymphs and young adults [*cf.* **41** 52]. Burning the plants beneath which the bugs hibernate in the mountains gives insufficient control and may lead to soil erosion.

The second paper is a summary of the first in French.

Jover (H.), Galichet (P.) & Vuillaume (M.). **Sur la biologie des chenilles de *Pimelephila ghesquierei* Tams parasite des palmiers à huile en pépinière.**—*Rev. Path. vég.* **30** no. 3 pp. 149–158, 7 figs., 2 refs. Paris, 1951.

Oil palms [*Elaeis guineënsis*] that had been growing for 14–18 months in a nursery in the Ivory Coast were found to have been severely damaged by larvae of *Pimelephila ghesquierei* Tams [*cf. R.A.E.*, A **20** 717, etc.; **27** 348], which were favoured by the heavy shade and high relative humidity prevailing in the nursery. The older trees showed injury due to the larvae of two successive generations. That caused by the first of these consisted at the time of the observations of notches on the outer surface of the petioles of the expanded leaves surrounding the terminal shoot, with some damage due to feeding on the leaflets. That by the second comprised feeding on the unopened leaves of the growing tip and their petioles, and this was still in progress, 2–4 larvae being found per plant. The younger palms showed damage of the second type only. The petioles were mined in some cases by larvae of *Temnoschoita quadripustulata* (F.), which gained entrance through the wounds made by *P. ghesquierei*, but never by larvae of the latter.

The observations indicated that the females oviposited in March–April at the base of the growing tip on palms that had been in the nursery for 14–15 months. The larvae occurred between the bases of the upper leaves and the growing tip and fed irregularly on the latter, at first attacking the unopened leaves and then, as plant growth proceeded, the petioles,

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sheltering in protective cases. They pupated in cocoons, two cocoons being commonly found in one shelter, and the complete life-cycle lasted at least 35–45 days, the adults emerging about 10th May. The damaged leaves had by that time expanded, and the females oviposited at the base of the new growing tip, and the process began again, further adults emerging in late June. The palms are usually planted out before they have been 20 months in the nursery, and conditions in the field do not favour further infestation. The damage thus occurs in March–July, during the period of the great rains, and the palms are sometimes killed by a heavy attack.

The measures recommended for the prevention of infestation include the avoidance of deep shade and high relative humidity in the nursery, good spacing of the young palms, the removal and destruction of useless or infested leaves, collection of the larvae and, if possible, planting in the nurseries at such a time that the trees reach the age of 14–18 months between August and February, when conditions are unfavourable for the pest. Palms reaching this age during the rainy season should be sprayed against the larvae and ovipositing adults, and a mixture of 5 per cent. BHC and 5 per cent. DDT with a wetting agent is recommended. Treatment should be particularly directed to the base of the growing point. Two methods by which the Pyralid was reared in the laboratory are briefly described.

Boyce (W. R.) & Newhook (F. J.). **Investigations into Yellow-leaf Disease of *Phormium*. I. History and Symptomatology.**—*N.Z. J. Sci. Tech.* **34** (A) suppl. 1 pp. 1–11, 1 col. pl., 7 figs., 7 refs. Wellington, N.Z., 1953.

Strzemienski (K.). **II. Translocation Disorders.**—*T.c.* pp. 12–16, 6 refs.

Newhook (F. J.). **III. Anatomical Aspects.**—*T.c.* pp. 17–30, 17 figs., 12 refs.

Cumber (R. A.). **IV. Experimental Induction of Yellow-leaf Condition in *Phormium tenax* Forst. by the Insect Vector *Oliarus atkinsoni* Myers (Hem., Cixiidae).**—*T.c.* pp. 31–40, 5 figs., 3 refs.

Boyce (S. W.) & others. **V. Transmission Experiments and Discussion on Control.**—*T.c.* pp. 41–46, 2 refs.

Much of the information in these papers on the yellow-leaf disease of *Phormium tenax* and its Cixiid vector, *Oliarus atkinsoni* Myers, in New Zealand has been noticed from other sources [*R.A.E.*, A **40** 95; **42** 209]. The first contains information on the distribution of the disease in New Zealand, a review of investigations to determine its cause, leading to the discovery of the virus concerned, and descriptions of the symptoms. Infected plants do not normally recover, but some evidence was obtained of the existence of resistant strains.

The second paper comprises an account of experiments in which the serious blockage of translocation that occurs in infected plants was demonstrated by means of dyes and solutions containing radioactive phosphorus as potassium dihydrogen phosphate. Descriptions of the anatomy of the plant and the histology of healthy and diseased tissues are given in the third, with an account of observations showing that vascular symptoms regularly precede the collapse of the lateral and main roots, rhizome rot and leaf symptoms.

The fourth paper contains descriptions of the work leading to the incrimination of *O. atkinsoni* as the vector of the virus [**40** 95] and an outline of

its bionomics [**42** 209], and the fifth an account of experiments on transmission, with a brief review of the possible preventive and control measures, which include direct control of the vector by flooding, replacement of many existing stands of *Phormium* to eliminate the disease and the use of virus-free or resistant stock.

STEUDEL (W.). **Zur Frage der Bekämpfung der Vergilbungskrankheit der *Beta*-Rüben durch Überträgerabtötung mit chemischen Mitteln. I. Die Wirkung des Präparates Systox auf die Blattlauspopulation der *Beta*-Rüben.** [Contribution to the Question of the Control of Virus Yellows of Beet by killing the Vectors with Chemicals. I. The Effect of Systox on the Aphid Population of Beet.]—*Z. PflKrankh.* **59** pt. 11–12 pp. 418–430, 8 graphs, 13 refs. Ludwigsburg, 1952. (With a Summary in English.)

In tests in Western Germany in 1950, sprays of 0·03, 0·05 and 0·1 per cent. Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate] and 0·1 per cent. parathion were applied to beet 1–3 times at about 90 gals. per acre between mid-June and early July and compared for their effect on *Aphis* (*Doralis*) *fabae* Scop. and *Myzus* (*Myzodes*) *persicae* (Sulz.), the vectors of beet yellows. All the sprays freed the plants initially from Aphids, and the rate of subsequent reinfestation was noted. This was greatly reduced by all treatments, as compared with none, and the greatest reductions were given by the two higher concentrations of Systox, which were about equal in effectiveness; all materials reduced the rate progressively with increased numbers of applications. *A. fabae* was more numerous than *M. persicae*, but was reduced to about the same level by 0·05–0·1 per cent. Systox. There was little difference between parathion and 0·03 per cent. Systox.

In 1951, beet sown between 19th April and 19th May was sprayed three times with 0·1 per cent. Systox, and reinfestation was studied after the second application, on 9th July. It was found that the population increase on the treated beet varied inversely with the age of the plants for both Aphids, so that the spray was the least effective on the youngest plants. This was due to the known preference of the winged migrants for the younger plants, the absence of any repellent effect on them, and, as shown in the laboratory, a reduced persistence of toxicity in young growing plants when the amount of toxicant available is limited.

These findings were confirmed in large-scale tests in five areas in 1951, when 2–3 applications of 0·05–0·1 per cent. Systox at 53–70 gals. per acre satisfactorily suppressed the Aphids and prevented the development of alates, which are the most important for virus transmission.

WELLENSTEIN (G.). **Zur Ernährungsbiologie der Roten Waldameise (*Formica rufa* L.).** [The Feeding Habits of the Red Forest Ant (*F. rufa*).]—*Z. PflKrankh.* **59** pt. 11–12 pp. 430–451, 6 figs., 49 refs. Ludwigsburg, 1952. (With a Summary in English.)

The observations described, which were begun in 1927, were carried out in forest districts in Germany, and the ants dealt with are chiefly the large form (*major*) of *Formica rufa rufopratensis* Forel [*cf. R.A.E.*, A **35** 212] and *F. congerens* Nyl. (*pratensis*, auct.). Previous work on the feeding habits of these ants, which is briefly reviewed, dealt mainly with particular aspects only, and little was known of the composition of their diet as a whole.

In the author's observations, the normal diet of the ants consisted of 62 per cent. honeydew, 33 per cent. insects, 4·5 per cent. sap from trees, 0·3 per cent. fungi and carrion, and 0·2 per cent. seeds, and there seemed to be little difference between the two in this respect. Honeydew was obtained from numerous species of sucking insects, a list of which is given. They were mainly Aphids, and none caused significant injury to the trees. They were tended particularly in spring and autumn, and the Aphids were afforded good protection from Ichneumonids and some from Syrphids, but none from Coccinellids. In early spring, when other food was scarce, the ants fed on sap, leaves, young shoots, flowers and berries, but caused little injury. A colony of *F. r. rufopratensis* of medium size was active over an area of about $1\frac{1}{4}$ acres in normal times and about one-third of this during outbreaks of forest pests, and killed an average of eight million insects a year, of which 5 per cent. were pests.

Lüdicke (M.). **Über das Verhalten von radioaktivem O,O-Diäthyl-O,p-nitrophenyl-monothiophosphat auf der Pflanze.** [On the Behaviour of radioactive Parathion applied to Plants.]—*Z. PflKrankh.* **59** pt. 11–12 pp. 451–459, 8 figs., 10 refs. Ludwigsburg, 1952. (With a Summary in English.)

The ability of parathion to penetrate plant tissues [*cf. R.A.E.*, A **41** 183, etc.] was further investigated by applying small quantities of an emulsion containing 0·05 per cent. parathion synthesised from radioactive phosphorus (P^{32}) to leaves, bark and fruit surfaces in the laboratory.

On leaves of *Ligustrum ovalifolium*, little material was lost after five days, and lateral diffusion after eight days amounted to less than 9 mm. There was no lateral diffusion in leaves of the fern *Polystichum falcatum*, and washing with water 44–45 days after treatment removed all trace of radioactivity. There was slight downward diffusion following treatment of 2–4-year-old twigs of *Prunus* spp., and in exceptional cases the material spread to adjacent lateral buds. Radioactivity was reduced by washing and disappeared when the surface layers of bark were removed. Parathion applied to stored apples penetrated up to 7 mm. into the flesh and up to 6 mm. laterally.

Franz (J.). *Laricobius erichsoni* **Rosenhauer (Col. Derodontidae), ein Räuber an Chermesiden.** [*L. erichsonii*, predacious on *Chermes*.]—*Z. PflKrankh.* **60** pt. 1 pp. 2–14, 10 figs., 7 refs. Ludwigsburg, 1953. (With a Summary in English.)

One of the predators recently sent from Europe to eastern Canada for use against *Chermes* (*Adelges*) *piceae* Ratz. on *Abies balsamea* [*cf. R.A.E.*, A **42** 199, 250] was *Laricobius erichsonii* Rosenh., and a preliminary account is here given of observations on this Derodontid carried out in 1950–52 mainly near Munich, where it attacked *C. piceae* on *Abies alba*. All stages are briefly described, and its European distribution is discussed and shown on a map. *L. erichsonii* attacks several species of *Chermes* and occurs in coniferous forests from the southern Alps and the Pyrenees to northern Germany and southern Denmark (including Funen); its northward distribution appears still to be increasing. It does not occur in eastern Germany, presumably because of the low rainfall and consequent aridity of the soil, in which some nine months of the year are passed, and has been recorded from no area with an annual rainfall of less than about 24 ins.

The observations near Munich showed that the adults emerged from hibernation during the first half of April and were active on days when the air temperature exceeded 14°C. [57·2°F.], flying readily, pairing, ovipositing and preying on all stages of *C. piceae* on the trunks of the trees except first-instar individuals. Males and females were present in equal numbers. They survived for at least a week without food at 15–17°C. [59–62·6°F.], and caged examples consumed an average of 24 eggs and five adults per day. About 50 eggs were laid per female, most of them during the first half of the oviposition period, which lasted from mid-April to mid-June. They were deposited singly, usually in or between egg-batches of *C. piceae*. The larvae hatched in about 12–16 days in May and fed at first on the eggs and then on the later stages of *C. piceae*, disguising themselves beneath the waxy secretions of the latter. There were four larval instars, the first three lasting for averages of 3·4, 3·5 and 3·9 days, respectively, at about 14°C. Larvae in the fourth instar spent an average of 4·2 days on the trees and then entered the ground litter or soil, where they remained for an average of 9·1 days before pupating, high humidity being essential at this stage. The pupal period lasted 13–14 days, and adult emergence began at the end of June. The young adults also fed on *C. piceae*, but were not very active and returned to the soil, mostly in August, to overwinter.

L. erichsonii was itself attacked by various insect predators, of which some destroyed the larvae on the trees and others attacked the larvae and pupae in the soil. The larvae were parasitisd by an undescribed Ichneumonid of the tribe Phrudini, which oviposited in the abdomen of the third- and fourth-instar larvae; the parasite larvae left their hosts after 13–17 days, when the latter had already entered the soil, and spun cocoons, in which they overwintered, the adults emerging at the beginning of May. Males are unknown. The percentage parasitism was low in 1950 but amounted to 58 in 1951. The parasite was found in all the areas investigated in southern Bavaria and was also observed in northern Switzerland. The larvae of *L. erichsonii* were also attacked by a disease of unknown origin, and all these agents of control were most injurious at the end of an outbreak of *C. piceae*, when the population of the beetle was concentrated on the few remaining *Chermes* colonies.

L. erichsonii was also observed attacking the more important *C.* (*Adelges*) *nordmannianae* Eckstein (*nüsslini* Börner) on *Abies alba*, but was much less effective against this species, since only the sistentes occur on the stems of the trees and these lay few eggs. The more prolific forms on the twigs were little attacked.

Domenichini (G.). **Contributo alla conoscenza del** *Callosobruchus maculatus* **F. e dei suoi parassiti.** [A Contribution to Knowledge of *Bruchus maculatus* and its Parasites.]—*Boll. Zool. agr. Bachic.* **17** fasc. 2 pp. 101–122, 9 figs., 12 refs. Turin, 1951.

In November 1946 a consignment of chick peas (*Cicer arietinum*) from Brazil that had been stored near Genoa was found to be infested by *Bruchus* (*Callosobruchus*) *maculatus* F., which had not been previously recorded in Italy. The egg, larvae and adults of this Bruchid are described, its distribution and the seeds attacked by it are briefly reviewed, and an account is given of observations on its bionomics in the laboratory in 1946–48.

Six generations were obtained in the year, the adults emerging in March–April, June, July, August, September and November, respectively. They paired 1–3 days after leaving the seeds in which they had developed, and the females oviposited soon after, showing no preference between chick

peas, beans (*Phaseolus vulgaris*) and soy beans. Usually only one egg was laid per seed, and the numbers deposited per female were 39–63 in August–September (when females survived for up to 18–20 days, with an average of 9–10, and males for up to 6–7 days, with an average of 4–5) and 4–23 in November, the average numbers being 51 and 12, respectively. The adults have been reported not to feed, or to ingest only liquids [*cf. R.A.E.*, A **13** 184], but observations showed that they fed to some extent on seeds with a slightly rough surface, such as chick peas, causing damage that was invisible to the naked eye, and solid material was found in their intestines. They did not feed on smooth seeds, and females provided with these laid reduced numbers of eggs. Although it is known that one summer generation can develop in the field, no eggs were laid when pairs were caged on chick-pea plants bearing open pods in the summer of 1947. The eggs hatched in 5–6 days, 54–92 hours and 12–14 days in June, July and November, respectively, and the larval and pupal stages lasted about three weeks and a week, respectively, in July–August. Winter was passed in the second larval instar.

Larvae and pupae of *B. maculatus* in the pupal cells were found to be parasitised by *Bruchobius laticeps* Ashm., the adults of which are described, and a new variety of *Anisopteromalus calandrae* (How.) (*Aplastomorpha vandinei* (Tucker)) described from the adults of both sexes as var. *brasiliensis*, n. Larvae of these Pteromalids fed externally on their hosts and pupated in the cells of the latter.

Grandori (R.), Grandori (L.) & Facetti (D.). **Effetti tossici selettivi della carbacolina su alcune specie di insetti.** [Selective toxic Effects of Carbacholine on certain Species of Insects.]—*Boll. Zool. agr. Bachic.* **17** fasc. 2 pp. 123–128, 2 refs. Turin, 1951.

Carbacholine (aminoformyl-β-hydroxyethyltrimethylammonium chloride) is a white, crystalline, hygroscopic powder, soluble in water but not in ether or chloroform. It is stable in solution, melts at 202°C., and has a physiological action similar to that of acetylcholine. In the tests described, it was found to act as a selective insecticide after the manner of the urethane 19258 (5,5-dimethyldihydroresorcinol-dimethylcarbamate [Dimetan]) [*cf. R.A.E.*, A **40** 360]. It was highly toxic to house-flies (*Musca domestica* L.), the median lethal dosage on injection being 1·1 mmg. per fly. Contact with a deposit of 0·7 gm. per sq. metre on glass caused knockdown in 2–7 hours and death in 2–24 hours, and the deposit was almost equally toxic after 40 days. On the other hand, injection into adults of *Leptinotarsa* (*Doryphora*) *decemlineata* (Say) of solutions at rates giving 0·1–1 mg. chemical per insect had no effect whatever, and adults of *Epicometis* (*Tropinota*) *hirta* (Poda) and *Calandra granaria* (L.) were also resistant to high doses.

Rainwater (C. F.), Dunnam (E. W.), Ivy (E. E.) & Scales (A. L.). **Calcium Carbonate as a Diluent for Insecticide Dusts.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 923–927, 9 refs. Menasha, Wis., 1954.

The following is based on the authors' introduction and summary. It is generally assumed that organic insecticides are incompatible with calcium carbonate, but as there appears to be no experimental evidence to support the assumption, insecticidal dusts in which calcium carbonate was the diluent were tested against various pests of cotton in the southern United States.

BHC and parathion dusts were tested against *Aphis gossypii* Glov., dusts of EPN [ethyl p-nitrophenyl thionobenzenephosphonate], toxaphene or heptachlor against *Anthonomus grandis* Boh., and DDT dusts against *Aphis gossypii*, *Polymerus basalis* (Reut.) and *Heliothis armigera* (Hb.). The calcium carbonate used was ground limestone that had been treated with a chemical to produce a free-flowing non-wettable powder. The dusts were stored in the laboratory in glass bottles at room temperature or in paper bags at 100 per cent. relative humidity, and they were tested in field cages or the laboratory at intervals for 52–66 weeks, in comparison with similar dusts formulated with pyrophyllite. The only dust to show evidence of breakdown was the mixture of BHC and calcium carbonate, which decreased somewhat in effectiveness after storage at the high humidity for 14 weeks, but then apparently remained stable for the rest of the 66 weeks. In subsequent field tests, a dust of 20 per cent. toxaphene and one of 5 per cent. DDT with enough BHC to give 3 per cent. γ isomer, prepared with the treated calcium carbonate and stored for 6–7 months, gave as good control of *Anthonomus* and *Heliothis* as the same toxicants prepared with commercial diluents, and were superior to them in dusting quality when applied by either ground machines or aeroplane.

Sun (Jung-yi Tung) & Sun (Yun-pei). **Microbioassay of Insecticides in Milk by a Feeding Method.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 927–930, 4 refs. Menasha, Wis., 1954.

The authors describe a method for the bioassay of small quantities of dieldrin in the milk of cows that have ingested or been treated with that insecticide. Samples of the milk are taken before and after the animal receives the insecticide and small amounts of formaldehyde are added as a preservative, after which the milk is shaken, homogenised and stored in a refrigerator at about 5°C. [41°F.]. After storage, it is again shaken and homogenised, to ensure uniform distribution of the toxicant. Standards are prepared by adding a calculated volume of a 1 per cent. solution of dieldrin in acetone to samples of the milk taken before treatment, to form a colloidal suspension, and diluting to suitable concentration with further untreated milk, or, if it is desired to use less acetone, by adding various amounts of a 0·1 per cent. acetone-water suspension of dieldrin to the untreated milk. For bioassay, 20-ml. lots of the various samples are poured into jars and absorbed by 1·2 gm. cotton-wool, and 100 day-old house-flies (*Musca domestica* L.) are introduced. The jars are kept at 27°C. [80·6°F.] and examined after 17–48 hours, depending on the rate of mortality. The latter was not affected by the acetone used in the standards, but it is advisable to add similar amounts to the test samples. The experiment is repeated on another day, and the average amount of dieldrin in the test milk is obtained by comparison with a log-probit dosage-mortality curve drawn from the average results given by the standards. A suitable range of mortality can be obtained by adding untreated milk to samples that contain too much dieldrin or a known amount of dieldrin to samples that contain too little. An example is given of the use of the method. The average median lethal dosage of dieldrin in milk for day-old flies was found to be about 2 parts per million, and the sensitivity of the method, as calculated by a formula modified from one used for a less sensitive method [*cf. R.A.E.*, A **40** 167–168], was 0·2 p.p.m., the factor of accuracy being 0·1. Sensitivity can be increased to 0·1 p.p.m. by using unfed flies less than 17 hours old.

Experiments with flies not more than 17 hours old showed that the

median lethal dosages after 48 hours were 13·6, 0·96, 1·13, 1·77, 5·39 and 5·72 p.p.m. for DDT, dieldrin, aldrin, lindane [γ BHC], isodrin and endrin [*cf.* **41** 268, note] in milk, with sensitivities of 1·4, 0·1, 0·11, 0·18, 0·54 and 0·57, respectively.

Griffiths (J. T.) & Thompson (W. L.). **Reduced Spray Programs for *Citrus* for Canning Plants in Florida.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 930–936, 7 refs. Menasha, Wis., 1954.

Increasing quantities of the *Citrus* fruits produced in Florida are being used for canning, and since the external quality of these is of little consequence, experiments were carried out on grapefruit and Valencia orange in 1948–51 to determine whether the normal number of dust or spray applications could be curtailed without affecting internal quality. Untreated trees, trees that received only dusting sulphur for the control of *Phyllocoptruta oleivora* (Ashm.) and trees that received a complete programme, comprising a spray of a zinc compound, dinex and wettable sulphur in January or February, a post-bloom spray of a copper compound and wettable sulphur, a summer oil emulsion for the control of *Chrysomphalus ficus* Ashm. (*aonidum*, auct.) and *Lepidosaphes beckii* (Newm.) and sulphur as needed for the control of the mite in autumn and winter, were compared on the basis of infestation by scale insects, extent of mite damage and melanose injury, internal fruit quality and average yield. In 1951, two of the sulphur plots were sprayed to control serious infestations of *Paratetranychus citri* (McG.). Although external quality was somewhat inferior on trees receiving sulphur only and much reduced on untreated trees, yield and internal quality were as good as on those receiving the complete programme, and it is concluded that it may prove possible to use reduced numbers of sprays and dusts if the fruit is to be canned.

McClurkin (J. I.). **Methyl Bromide Fumigation of Soil for Destruction of White-fringed Beetle Larvae.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 940–944, 3 graphs, 6 refs. Menasha, Wis., 1954.

Soil fumigation with methyl bromide was officially approved in the United States in 1942 as a quarantine measure against larvae of *Graphognathus* spp. [*R.A.E.*, A **31** 23], and an account is given of subsequent work carried out in Mississippi and North Carolina to improve the treatment recommended. The test plots were covered with asphalted builders' paper after treatment to retard loss of gas, and larvae were subsequently dug from the centre of each and observed for mortality.

Technical methyl bromide has such a low boiling point (40°F.) that a special apparatus with a closed system is needed for soil application, and 10 per cent. solutions of methyl bromide in ethylene dichloride or a mixture of ethylene dichloride and carbon tetrachloride (3 : 1), which are less volatile and can be applied by means of an open, adjustable injector, were therefore included in the tests. Technical methyl bromide applied in fixed quantities of 7 ml. at a depth of six inches gave complete mortality at a spacing of 18 × 18 ins. (3·1 ml. per sq. ft.) at a soil temperature of 50°F., at 21 × 21 ins. (2·4 ml. per sq. ft.) at 65° and at 24 × 24 ins. (1·8 ml. per sq. ft.) at 75° or above. The solutions were effective and convenient in use, but slower in action. They were applied in different amounts at constant spacing and gave almost complete kill at dosages ranging from 18 ml. solution per sq. ft. at 40°F. to 2 ml. per sq. ft. at 80° when applied at a spacing of 12 × 12 ins., from 18 ml. at 50° to 6 ml. at 80° at 15 × 15 ins., and from 20 ml. at 50° to 8 ml. at 80° at 18 × 18 ins.

The insecticidal effect appeared to be complete within a few days, and it was therefore sufficient for the plots to remain covered for four days after treatment with technical methyl bromide and for seven days after treatment with the solutions. Sensitive plants were damaged if set out before the soil had been aerated.

As a result of the tests, the administrative instructions of 1942 [*loc. cit.*] were revised in 1948 to permit treatment with technical methyl bromide in amounts of 7 ml. per injection at spacings of 15, 18, 21 and 24 ins. when soil temperatures are 45–55, 55–65, 65–75 and 75°F. and above, respectively, the plots remaining covered for four days after treatment, and with 10 per cent. methyl bromide solutions at a 12-inch spacing in amounts of 20, 16, 12, 8 and 5 ml. per injection at temperatures of 40–50, 50–60, 60–70, 70–80 and 80°F. and above, respectively, the plots remaining covered for seven days.

Griffin (J. A.) & Eden (W. G.). **Control of the Gulf Wireworm in Sweet-potatoes in Alabama.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 948–951, 5 refs. Menasha, Wis., 1954.

Conoderus (*Heteroderes*) *amplicollis* (Gylh.) [previously recorded as *H. laurentii* (Guér.) (*R.A.E.*, A **24** 522)] is a major pest of sweet potatoes throughout Alabama, the larvae feeding on the tubers. Although crop failure rarely results, the appearance and consequent market value of the tubers is marred and the feeding punctures afford a means of entry for secondary infections, which may cause losses in storage. Experiments were carried out in 1951 and 1952 in which insecticides were introduced into the soil in row treatments about two weeks before planting. Most of the materials were dusts, which were mixed with fertiliser and applied in the open furrows by hand, but ethylene dibromide, a liquid fumigant, was poured in after the application of fertiliser; the furrows were covered immediately after application.

In 1951, when infestation was light and yields low, chlordane, BHC (3 per cent. γ isomer) and lindane [almost pure γ BHC] at 2 lb., heptachlor, dieldrin, aldrin and parathion at 1 lb., toxaphene at 10 lb. and ethylene dibromide at 8·2 U.S. gals. per acre all gave some control, the first two being the best, though there were inconsistencies, and in 1952, lindane, aldrin and heptachlor at 2 lb., BHC (3 per cent. γ isomer) at 3 lb. and dieldrin at 8 lb. per acre gave good control, heptachlor and dieldrin at 8 lb. being insignificantly and significantly better, respectively, than the same materials at 2 lb. In the two years, chlordane at 2–8 lb. and toxaphene at 10 lb. gave good control in some tests and none in others, and parathion at 1–2 lb. and ethylene dibromide at 8·2 U.S. gals. had no practical effect. None of the insecticides caused tainting of the tubers or any reduction in yield.

Massey (C. L.), Chisholm (R. D.) & Wygant (N. D.). **Chemical Control of the Engelmann Spruce Beetle in Colorado.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 951–955. Menasha, Wis., 1954.

In 1950, a solution of o-dichlorobenzene in fuel oil (1 : 6), which had proved effective in previous tests, was applied on a large scale to the trunks of spruce trees in Colorado for the control of *Dendroctonus engelmanni* Hopk. The material was costly and scarce, however, and tests were simultaneously begun to compare other fumigants with it [*cf. R.A.E.*, A **42** 83]. Emulsion concentrates were prepared by dissolving the chemical

in fuel oil or Stoddard solvent with the addition of a mixture of Triton X-100 (an alkylated arylpolyether alcohol) and Triton B-1956 (a modified phthalic glycerol alkyd resin) as emulsifier, and these were readily emulsified in water, which was available close to the trees. When applied to infested log sections in the laboratory in emulsions containing fuel oil and 80 per cent. water, ethylene dibromide at 1 and 2 lb. per 5 U.S. gals. gave 32 and 70·7 per cent. mortality of the insects present, respectively, as compared with 5·5 per cent. in untreated logs. Chlorinated naphthalene and trichlorobenzene at 1–4 lb. were unsatisfactory. In field tests, ethylene-dibromide emulsions were applied to the point of run-off to the trunks of standing trees or to log sections, the former being treated to a height of 20 ft. with about 3 U.S. gals. spray. Both Stoddard solvent and fuel oil proved effective as solvents, and a minimum of 15 per cent. oil in the finished spray and up to 3 lb. ethylene dibromide per 5 U.S. gals. gave satisfactory mortality. The addition of zone oil (a paraffin-base lubricating oil) did not improve control. In one test, a water-in-oil emulsion of ethylene dibromide (prepared with only Triton B-1956 as emulsifier) appeared to be as effective as the usual oil-in-water emulsions.

In field and laboratory tests of solutions in fuel oil, ethylene dibromide gave satisfactory control at 1·5 lb. per 5 U.S. gals. and good control at half this concentration. Solutions of o-dichlorobenzene, alone and with p-dichlorobenzene (1 : 1) were also effective, but had to be used at more than twice the concentration of ethylene dibromide to give comparable results, and trichlorobenzene and chlorinated naphthalene were less effective. Dichloroethyl ether gave complete mortality at 4 lb. per 5 U.S. gals. and was not tested at lower concentrations. The effectiveness of ethylene-dibromide solution was increased by the addition of Triton B-1956 in the laboratory, but improvement due to the addition of this emulsifier, isopropyl alcohol or zone oil was not demonstrated in the field because of the high mortality obtained in all applications. Further research is needed to determine the effectiveness of additives and the minimum concentration of ethylene dibromide.

Although 1·5 lb. ethylene dibromide in oil solution was as effective as 3 lb. in emulsion, the increased cost of the fumigant in the latter is more than offset by the larger proportion of oil in the solution and the higher transport charges. The emulsion was used extensively in Colorado in August 1952 and was as effective as the solution of o-dichlorobenzene in fuel oil and much pleasanter to handle.

Tashiro (H.) & Gambrell (F. L.). **Control of the European Chafer on deciduous Nursery Stock** *in Situ*.—*J. econ. Ent.* **46** (1953) no. 6 pp. 956–960, 2 refs. Menasha, Wis., 1954.

A tentative treatment for deciduous trees that were to be moved with a ball of soil from nurseries infested by *Amphimallon majalis* (Razoum) in New York and were too large for dipping was suggested in August 1951. It involved removing soil to a depth of at least three inches over an area three feet wider than the proposed soil ball, levelling, applying fumigant to the exposed surface and leaving the area undisturbed for five days, after which the ball might be removed. The approved fumigant was a mixture of 13 per cent. ethylene dibromide, 67·5 per cent. isopropyl alcohol and 6·5 per cent. each of chlordane (which has a persistent toxicity), Cellosolve and Tween-20, and it was to be applied at the rate of 40 ml. per U.S. gal. per square yard against the larvae between 1st September and 10th May, at a soil temperature of at least 50°F. at a depth of two inches. The tree was to be removed not later than 1st June.

Investigations on the effectiveness of this treatment were carried out in the autumns of 1951–52 and the spring of 1952. In tests in September–November, the soil was removed as required, and larvae were put on the exposed surface 2–7 days before treatment with 20 or 40 ml. fumigant per U.S. gal. They were recovered five days after treatment and kept in untreated soil for two weeks for observations on mortality. Both treatments proved effective at mean soil temperatures above 45°F., complete kills being obtained with the 40 ml. dosage in five days in some cases and within the further fortnight in the rest; at 42° or less, some larvae survived this period. The lower dosage proved only slightly less effective, and there were no differences due to interval before treatment.

In the spring tests, larvae were placed on the soil a week before treatment, doses of 10, 20, 40 and 80 ml. of the mixture per sq. yard were applied between 10th April and 29th May, and the larvae were recovered five or ten days later and kept in untreated soil for two weeks. Control from exposure for five days was generally less than in the autumn; no normal larvae were recovered from trees receiving 40 ml. mixture after 8th May, but larvae that were apparently normal survived treatment with 20 ml. A dosage of 10 ml. was inadequate even with an exposure of ten days, whereas one of 20 ml. for ten days gave control comparable with that from 40 ml. for five days. The highest dosage was giving practically complete control after five days by the beginning of May and was not tested further. Exposing prepupae or pupae to a dosage of 20 or 40 ml. for five days in June 1952 gave no control. The treatments caused no injury to any of the trees.

Stitt (L. L.). **Insecticide Tests for Control of Maggots in Turnips.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 961–965, 1 fig., 3 refs. Menasha, Wis., 1954.

Dipterous larvae, mainly *Hylemyia brassicae* (Bch.), cause severe injury to turnips in western Washington and have not been controlled by treatments that proved successful on cabbage, cauliflower and radish. Investigations were therefore carried out in June 1951 with insecticides applied in the furrow with the seed and in April, June and September 1952 with insecticides either applied in the furrow or broadcast and raked into the soil. All were applied after the seed was sown. Dusts of aldrin and heptachlor, applied in the furrow at about 0·015–0·1 lb. active ingredient per 1,000 linear feet of row, gave satisfactory control, left residues of 0·231–0·439 and 0–0·078 parts per million, respectively, in the turnips and did not affect the flavour of the latter. Broadcast applications equivalent to 0·09–0·43 lb. per 1,000 ft. were less effective than furrow treatments. Inferior results were given by dusts of chlordane, dieldrin, isodrin and BHC (1 per cent. γ isomer) at comparable rates and by an emulsion spray of endrin [*cf. R.A.E.*, A **41** 268, note], and dusts of mercurous chloride (calomel) in gypsum (3·39 per cent. mercury), 1 per cent. lindane [almost pure γ BHC], 5 per cent. malathion and 5 per cent. ethyl-DDD (1,1-bis(p-ethylphenyl)-2,2-dichloroethane) and a spray containing creosote oil and BHC were unsatisfactory.

Turnipseed (G. F.) & Smith (C. F.). **Life History and Control of Scales on Apples in North Carolina.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 969–972, 2 graphs. Menasha, Wis., 1954.

Quadraspidiotus (*Aspidiotus*) *forbesi* (Johnson) is the most important of the Coccids that infest apple at elevations below 3,000 ft. in western North Carolina. It has two generations a year and overwinters as the adult

female. The fruits are infested by crawlers of both generations, and the trunks, branches and twigs are also attacked. In 1950, the scale was well controlled by one spray of dormant oil with DNC (sodium) and five applications of 1·5 lb. 15 per cent. wettable parathion per 100 U.S. gals., beginning at the pink stage, and much reduced by one dormant oil spray, one spray of 1 lb. 15 per cent. wettable parathion at the pink stage and four of 0·75 lb. 15 per cent. parathion with 1 lb. 50 per cent. wettable DDT per 100 U.S. gals., beginning at the first cover spray, but schedules comprising dormant oil followed by four DDT or six lead-arsenate sprays were unsatisfactory. In 1951, commercial control was given by dormant or delayed-dormant sprays of 2 per cent. oil alone.

Lepidosaphes ulmi (L.) is a serious but localised pest of apples at the higher altitudes, has two generations a year and overwinters in the egg under the female scale. Crawlers of the overwintered generation settle on branches, twigs and trunks, and those of the first generation also on the fruits. A high degree of control is given by natural enemies in heavily infested orchards. In 1950, two dormant applications, two weeks apart, of 3 per cent. oil caused the scales to drop off early in the spring and gave complete control throughout 1951, and delayed-dormant applications of the same spray gave commercially clean fruits and reduced the scale to a minimum.

Serious infestation by *Chionaspis furfura* (Fitch), which is injurious at the higher elevations, is confined to one area in western North Carolina. There are two generations a year, and winter is passed by the eggs under the female scale. Large and small branches are sometimes killed by the Coccid, and the fruits are also infested. In 1952, two oil sprays two weeks apart at the dormant stage, or one at the dormant stage followed by two of parathion against the crawlers, controlled heavy populations. Oil as a delayed-dormant spray or parathion alone applied twice against the crawlers gave only fair control, but might be satisfactory against a light infestation.

Goodhue (L. D.). **Some Observations on the Use of Isoparaffin Oils as Carriers for agricultural Chemicals.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 986–988, 2 refs. Menasha, Wis., 1954.

Liquid carriers for agricultural chemicals are generally limited to water or water emulsions of certain oils, but in recent years isoparaffin fractions have become available that are characterised by lack of odour, very low toxicity to plants, ability to spread on leaf surfaces and, apparently, lower toxicity to animals than ordinary hydrocarbon oils in the same boiling range. These isoparaffins are essentially complex mixtures of saturated branched-chain paraffin hydrocarbons, and two, Soltrol 140, in the boiling range of 361–400°F., and Soltrol 180, in the range 402–481°F., which contained no more than a trace of olefins, naphthenes or aromatics and probably only small amounts of normal paraffins, were used in the tests described.

On cotton leaves, droplets of these oils spread to cover about 50 times the area covered by the same volume of fuel, diesel or aromatic oil, and in tests on crop plants, Soltrol 180 was less phytotoxic than diesel fuel on 12 species and than dormant spray oil, deodorised kerosene, kerosene or white mineral oil on seven, lettuce being the only plant injured by it. In sunlight, some oxidation of Soltrol 180 to more phytotoxic peroxides or hydroperoxides took place in six weeks, but this could be reduced by the addition of inhibitors, and Soltrol 140 stored in the open under normal conditions for five years showed no peroxides or hydroperoxides and proved non-phytotoxic.

The isoparaffins are only fair solvents for some insecticides, and a table is given showing the approximate solubilities of several organic insecticides,

a defoliant and a fungicide in Soltrol 180. As pure pyrethrins are soluble in it in all proportions but polymers and waxes insoluble, an oil of this type might be used as a selective solvent for the extraction of pyrethrum from the flowers to obtain a more refined extract. Similarly, pure chlordane is soluble in all proportions and the tars in impure chlordane insoluble.

In field tests, aldrin, heptachlor, endrin [*cf. R.A.E.*, A **41** 268, note], toxaphene and a mixture of DDT and dieldrin were applied to cotton plants at the recommended rates in 2–3 U.S. gals. Soltrol 180 per acre and gave good control of insects. Some insecticides proved more phytotoxic than others when applied in this way, aldrin and endrin causing no damage and toxaphene, which is soluble in all proportions, extreme injury. These oils may also prove useful in fruit washes or dips for the control of various insects on *Citrus*, and may have still further uses [*cf.* B **42** 134].

Ferguson (G. R.) & Ott (D. J.). **An effective durable-type Mothproofing Agent.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 991–995, 17 refs. Menasha, Wis., 1954.

The authors review literature on the moth-proofing agent Mitin (the sodium salt of N-(3,4-dichlorophenyl)-N′-2-(2-sulpho-4-chlorophenoxy)-5-chlorophenyl-urea) [*cf. R.A.E.*, A **39** 5] and give an account of its chemical and physical properties, methods of applying it and the results of laboratory tests with the commercial preparation Mitin FF Conc., which contains 42·5 per cent. of it.

When this was tested by standard methods [*cf.* **31** 17], it gave complete kills of larvae of *Tineola bisselliella* (Humm.) 7, 14 and 25 days old in 7, 14 and 21 days, respectively, at a concentration of 1 per cent. by weight on wool and more rapidly at concentrations of 1·5–2 per cent., acting as a stomach poison and not as a repellent, and many tests with treated woollen fabrics of different kinds confirmed that it was very effective against this moth. Concentrations of 0·025–2·5 per cent. gave complete kills of month-old larvae of *Attagenus piceus* (Ol.) in 28–14 days and fair kills of larvae eight weeks old, but were ineffective against those 12 and 16 weeks old, though an apparent repellent effect on these, as indicated by a reduction in the weights of excreta, may have been due to poisoning. Identical tests with larvae of *Anthrenus vorax* Waterh., which has a shorter life-cycle, when they were 4, 6 and 8 weeks old, showed similar reductions in excreta, and comparisons of the two species on commercially treated fabrics indicated similar degrees of feeding.

Tests of treated materials before and after they were dry-cleaned 50 times showed no reduction in mortality of *Tineola* in two weeks and a slight decrease in palatibility to *Attagenus* as indicated by weight of excreta; washing 5–25 times had little or no effect on mortality of *Tineola* and caused only a slight increase in palatibility to *Attagenus*. Samples of treated flannel and bleached or unbleached camel's hair that had been stored for 5–6 years were still satisfactorily protected.

Bryson (H. R.), Wilbur (D. A.) & Burkhardt (C. C.). **The Western Corn Rootworm, *Diabrotica virgifera* Lec. in Kansas.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 995–999, 2 figs., 4 refs. Menasha, Wis., 1954.

The following is substantially the author's summary. *Diabrotica virgifera* Lec. was first reported to be causing injury to maize in Kansas in 1945 in Norton County, and since that time, reports from other counties indicate an eastward movement of the species. It was not found in any stage in

Nemaha, Pottawatomie and Wabaunsee counties in 1952, and this marks the known eastern boundary of present distribution in the State.

The severest root damage by the larvae and the greatest number of adults were observed in fields that had been planted with maize for 15 years in succession. Feeding by the larvae continued from mid-June until late July, but its duration apparently varied with season, soil conditions and other environmental factors. Both the main roots and brace roots touching the soil were completely destroyed, and where infestation was heavy, the bases of the stems were so severely tunnelled that the burrows extended into the centre of the stalk. The adults were found feeding on all the aerial parts of the growing maize plants, and up to 125 were observed in the whorl when the tassel was emerging. Although considerable injury was caused to the leaves, the outstanding damage resulted from clipping of the silks. When the adults were abundant, all the silks were severed close to the tips of the ears, and when this occurred as the ears began to silk, fertilisation remained incomplete. Sorghums, although in many cases adjacent to heavily infested maize fields, were not attacked [*cf. R.A.E.*, A **35** 362].

Riehl (L. A.) & Carman (G. E.). **Narrow-cut Petroleum Fractions of naphthenic and paraffinic Composition for Control of California Red Scale.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1007–1013, 1 graph, 15 refs. Menasha, Wis., 1954.

Field experiments were carried out in California in 1948–50 to determine the relation of chemical composition and physical properties to the insecticidal efficiency of two series of fractions of petroleum oils against *Aonidiella aurantii* (Mask.) on orange. The two oil stocks selected for fractionation represented distinctly naphthenic and paraffinic types, respectively, and narrow-cut fractions of each were freed from unsaturated compounds by exhaustive treatment with sulphuric acid or its equivalent. The main physical characteristics of the oils used are tabulated.

Dilute aqueous emulsions were prepared by the tank-mix method and applied when air temperatures and relative humidities were within the range considered safe for the application of such oils to *Citrus*, and populations of adult females on fruits and leaves were counted before and after treatment. The results indicated that highly paraffinic oils are more effective against the scale than naphthenic oils and that the efficiency of petroleum spray oils against it can be increased by proper selection of the fractions used with respect to molecular weight and paraffinicity. Insecticidal effectiveness increased with increasing molecular weight within the range of 220–360, the correlation being apparently better for highly paraffinic oils than for those of naphthenic composition. At least one generation of progeny developed on all plots between the time of the spray application and the first post-treatment count, and the residual film of oil affected the settling of the crawlers.

Riehl (L. A.) & Jeppson (L. R.). **Narrow-cut Petroleum Fractions of naphthenic and paraffinic Composition for Control of Citrus Red Mite and Citrus Bud Mite.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1014–1020, 1 graph, 13 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. The efficiency of highly refined petroleum oils of distinctly naphthenic and paraffinic types for the control of *Paratetranychus* (*Metatetranychus*) *citri* (McG.) on orange and

lemon and of *Aceria sheldoni* (Ewing) on lemon was investigated in the field in southern California in 1948–50, two series of narrow-cut fractions [see preceding abstract] and also other fractions comparable in distillation range to commercial foliage spray oils being compared. It was found that the efficiency of the sprays against *P. citri* could be increased by proper selection for composition and molecular weight. The paraffinic oils were more effective than the naphthenic ones, and there was a positive correlation between molecular weight and acaricidal efficiency, the optimum weight for highly paraffinic oils being approximately 340. When used at 2 quarts or less per 100 gals. spray, the various fractions failed to give consistent control of *A. sheldoni* at the commercial level and showed no association between efficiency and molecular configuration or size.

Haynes (H. L.), Granett (P.), Sacktor (B.) & Bowery (T. G.). **A Butoxypolypropylene Glycol to control the European Red Mite on Apples.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1020–1025, 4 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Preliminary spray tests in the greenhouse showed that a butoxypolypropylene glycol with a molecular weight of approximately 800, and formulations of it with sodium 5,11-diethylpentadecyl-8-sulphate as a wetting agent, gave satisfactory control of *Tetranychus bimaculatus* Harvey and *T. telarius* (L.) (*althaeae* v. Hanst.) on beans and of red spider mites on many other plants. Field tests in New Jersey in 1947–48 showed that the glycol at 1·5 lb. and the mixture (4:1) at 1·7 lb. per 100 U.S. gals. gave control of *Paratetranychus pilosus* (C. & F.) on apple that was equivalent or superior to that from 1·5 lb. dinex (dicyclohexylamine) but somewhat inferior to that from 4 oz. parathion per 100 U.S. gals. When infestation was heavy, two or three applications of any one of these materials were necessary. The glycol, alone or with its wetting agent, caused no injury to apple foliage or fruits when used at effective concentrations. It was compatible with DDT and with a fungicidal mixture of 2-heptadecyl, 2-pentadecyl and 2-heptadecenyl glyoxalidines, which itself possessed considerable acaricidal properties.

Butoxypolypropylene glycol is of particular interest because of its very low toxicity to warm-blooded animals. There is no danger to those applying it, and it can be used late in the season, even shortly before harvest, without danger of poisonous residues.

Landis (B. J.) & Gibson (K. E.). **Abundance of Mites on Potatoes treated with DDT, Sulfur, Parathion, or Malathion for Aphid Control.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1025–1029, 1 ref. Menasha, Wis., 1954.

The following is based on the authors' summary. During June or July, most of the potato fields in the Yakima Valley of Washington become infested by *Tetranychus bimaculatus* Harvey, lucerne fields being an important source of the mites. Records taken in the course of experiments on Aphid control in 1949–52 showed that the mite population developed rapidly where DDT dusts or sprays were applied [*cf. R.A.E.*, A **37** 202] and that damage to the autumn crop occurred occasionally. The mites developed more rapidly after dusting with 5 per cent. DDT than after a dust of 33·3 per cent. cryolite (sodium fluoaluminate). The addition of sulphur to DDT dusts prevented rapid increase, and 50 per cent. sulphur in the mixture gave good control and was not inferior to 75 or 80 per cent. Dusts containing 0·5–1 per cent. parathion were about as effective as 5 per cent. DDT with 50 per cent. sulphur, but the plots became reinfested more

rapidly. Four or five applications of a dust containing 5 per cent. DDT, 0·5 per cent. parathion and 50 per cent. sulphur applied from the ground prevented injury from mites throughout the season and were superior to aeroplane dusts of the same materials or a spray of 4 per cent. DDT with 0·4 per cent. parathion. Malathion, applied as a 5 per cent. dust or a 1·7 per cent. spray, gave good immediate control, although it had not such a long residual effect as the dust of DDT, parathion and sulphur.

Kulash (W. M.). **Slurry Treatment for the Control of Stored Corn Insect Pests.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1029–1034, 1 ref. Menasha, Wis., 1954.

In laboratory tests in 1951–52, maize seed fairly heavily infested by *Calandra* (*Sitophilus*) *oryzae* (L.) was treated in a commercial slurry treater on 29th November 1951 with preparations containing 1 or 0·75 per cent. pyrethrins and 10 per cent. piperonyl butoxide, used at 50, 100 or 200 parts per million by weight of the shelled maize, γ BHC as lindane at 0·025, 0·5 or 10 p.p.m. or an isoparaffinic oil at 3,500 p.p.m. All but the last were applied in water at the rate of 230 ml. fluid per 100 lb. maize, and the treated seed was stored at 74°F. for about four months, in an unheated room for about seven months or in an unheated room for three months and then at 74°F. for three. Weevil population, weevil mortality and increase in numbers of egg and feeding punctures and adult emergence holes at various periods after treatment were used to assess control, and it was found that lindane at 10 p.p.m., which gave 99·4 per cent. mortality over four months in the maize stored at 74°, was the most effective material, followed by the isoparaffinic oil and lindane at 0·5 p.p.m. The weevil population and damage increased most in the maize stored at 74° and least in that stored under unheated conditions.

Parencia jr. (C. R.) & Cowan jr. (C. B.). **Control of the Boll Weevil and the Bollworm with organic Insecticides in 1952.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1034–1038, 1 ref. Menasha, Wis., 1954.

The following is based on the authors' summary. Small-plot and large-scale field experiments in which insecticides were applied to cotton as dusts and low-volume emulsion sprays were carried out at Waco, Texas, during 1952 for the control of late-season infestations of *Anthonomus grandis* Boh. and *Heliothis armigera* (Hb.). The spray quantities are given as amounts of actual toxicant per acre; sprays were applied at 4·5–6 U.S. gals. and dusts at about 15 lb. per acre in most tests, and 3–9 applications were made in July–August.

In small-plot experiments against *Anthonomus*, a spray of 0·5 or 0·625 lb. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] with 0·75 lb. DDT gave control equal to that from a dust mixture containing enough BHC to give 3 per cent. γ isomer with 5 per cent. DDT and 40 per cent. sulphur, and there was no significant difference between sprays of 0·33 lb. endrin [*cf. R.A.E.*, A **41** 268, note], 1·9 lb. toxaphene with 0·92 lb. DDT, or 0·33 lb. aldrin, 0·27 lb. dieldrin or 0·33 lb. heptachlor, all three with 0·67 lb. DDT, which gave good control. A dust of lime-free calcium arsenate containing 1 per cent. parathion, one of 20 per cent. toxaphene with 40 per cent. sulphur and a spray of 0·3 lb. endrin were also very effective and resulted in significantly higher yields than a spray of 0·2 lb. endrin. In these tests, all treatments gave significant control as compared with untreated plots.

In one large-scale experiment, a spray of 0·5 lb. Metacide [methyl-parathion with a smaller quantity of parathion] gave slightly better control of *Anthonomus* than one of 2 lb. toxaphene with 1 lb. DDT, but failed to control *Heliothis*, and in another, lime-free calcium arsenate containing 1 per cent. parathion showed longer residual toxicity to *Anthonomus* than a dust of 20 per cent. toxaphene and 40 per cent. sulphur, though all materials gave good control of this weevil.

In one small-plot experiment against *Heliothis*, a dust containing enough BHC to give 2 per cent. γ isomer, with 10 per cent. DDT and 40 per cent. sulphur, gave good control and resulted in a significantly higher yield than lime-free calcium arsenate with 2·5 per cent. DDT and 1 per cent. parathion or than a spray of 0·75 lb. DDT and BHC to give 0·45 lb. γ isomer. In another, a dust of 10 per cent. DDT with 1 per cent. methyl-parathion and sprays of 2 lb. toxaphene with 1 lb. DDT and of 0·375 lb. endrin resulted in about equal control and in significantly better yields than a spray of 3 lb. toxaphene alone, which proved less toxic.

RUDE (C. S.). **Trends in Pink Bollworm Control in the Laguna of Mexico.** —*J. econ. Ent.* **46** (1953) no. 6 pp. 1038–1041, 1 graph. Menasha, Wis., 1954.

Much cotton is grown under irrigation in the Laguna region of northern Mexico. *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) was introduced in 1911, became generally distributed by 1916 and caused severe commercial damage from 1920 onwards. Efforts were made in 1942 to enforce cultural control measures, and for several years it has been required that all cotton stems should be destroyed by 31st October and the ground deeply ploughed by 31st December; the cultivation of ratoon cotton is prohibited. Cotton-seed heating machines are to be operated as part of the continuous ginning process in all gins, and gin trash must be burnt. Segregation of seed cotton, pressed lint, seed and bagging is compulsory at all times, and the gin yards and houses and seed-cotton stores must be kept clean.

In insecticide tests, DDT gave promising results in 1946–47 [*cf. R.A.E.*, A **39** 115], and has been used extensively since 1948. It is combined with other materials for the control of other insects, and the most economical and satisfactory mixture has been found to be a dust of 10 per cent. DDT, BHC to give 2 per cent. γ isomer and 40 per cent. sulphur, applied at about 13·5 lb. per acre; 3–11 applications per season give good control, 6–7 being usually necessary. Applications are made either at weekly intervals, beginning when infestation is first observed, or when the cotton plants have 6–8 leaves and again 7 and 28 days later, with additional applications as needed; the second schedule is more generally used, as it results in better insect control with fewer applications.

Cultural control and gin sanitation, supplemented by the use of insecticides, reduced infestation from an average of at least 75 per cent. in green bolls with an average of 6·35 larvae per boll in 1934–42 to 7·79 per cent. in green bolls with 0·13 larva per boll in 1951. Owing to the lack of commercial damage in that year, cultural control was neglected by some growers, with the result that the population was high in the spring of 1952 and, in spite of the intensive use of insecticides, infestation was serious in many fields, the seasonal average in green bolls increasing to 16·8 per cent. with 0·198 larva per boll. It is concluded that no one method will afford control. The combined measures resulted in yields that were almost twice as great in 1949–51 as in 1936–40, with an increase in the percentage of the crop graded middling or better from 58·5 to 78·2.

Scott jr. (D. B.). **The economic Biology of Collembola.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1048–1051, 13 refs. Menasha, Wis., 1954.

The following is based on the author's summary. The Collembola are a comparatively unknown order of insects that occasionally cause considerable damage. Of the approximately 2,200 species described, 70 may be classed as economically important. Lists are given of species that attack sugarcane in Hawaii and Louisiana, mushrooms, and other plants, mainly seeds and seedlings, or that enter houses. Chlordane, aldrin and dieldrin at the rates recommended against soil insects have given very effective control, and nicotine and TEPP [tetraethyl pyrophosphate] have proved effective in mushroom culture, where toxic residues must be avoided. TEPP should be used on mushrooms before the buttons have formed, to avoid scorching the caps. Pyrethrum is ineffective, and DDT and rotenone of little promise.

Wene (G. P.). **Control of migratory Boll Weevils in the Lower Rio Grande Valley of Texas.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1051–1053, 5 refs. Menasha, Wis., 1954.

Because of weather conditions favourable to *Anthonomus grandis* Boh. on cotton in the Lower Rio Grande Valley of Texas in 1951 and 1952, migratory weevils were of major importance, and experiments were carried out to determine the most effective insecticide for their control. When applied six times at intervals of about five days in July, aldrin and EPN [ethyl p-nitrophenyl thionobenzenephosphonate] at 0·5 lb. in 15 U.S. gals. water per acre were as effective as 0·29 lb. dieldrin until 14th–18th July, when the weevils began to migrate, but less so later. Sprays of 0·2–0·4 lb. endrin [*cf. R.A.E.*, A **41** 268, note] in 15 U.S. gals. water per acre reduced the adult population by 50–60 per cent. in 24 hours in a very heavily infested field, whereas 0·05–0·1 lb. endrin, 3 lb. toxaphene or 0·75 lb. EPN had little effect.

When applied at about 20 lb. per acre at 4–5-day intervals, dusts containing 2–3 per cent. γ BHC, 10 per cent. DDT and 40 per cent. sulphur or 20 per cent. toxaphene with 10 per cent. DDT had little effect on migrating weevils, whereas one of 2·5 per cent. dieldrin with 10 per cent. DDT gave good control. In a very heavily infested field that was treated at intervals of 2–4 days, the dust of dieldrin and DDT was more effective and more rapid in action than the mixture of DDT, sulphur and 3 per cent. γ BHC, and these were better than 20 per cent. toxaphene or 50 per cent. calcium arsenate with sulphur in reducing the numbers of adults. The first two gave excellent control for the first two days after application, but permitted great increases in population on the third and fourth days, indicating that the interval between applications should be reduced to 3–4 days during migration.

Elmore (J. C.). **Treatment of Bean Seed for the Control of the Seed-corn Maggot.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1054–1059, 2 figs., 7 refs. Menasha, Wis., 1954.

Hylemyia ciliczura (Rond.) is an important pest of lima beans in southern California and has recently increased in importance, apparently owing to the chemical control of wireworms [*Limonius californicus* (Mannh.)] that prey on the larvae [*cf. R.A.E.*, A **42** 304], the planting of winter crops that had been previously avoided to discourage the development of wireworms, and the increased cultivation of lucerne and of vegetables for freezing.

In preliminary experiments on control in 1948–49, treating the bean seeds with mixtures of chlordane, aldrin or lindane [almost pure γ BHC] with a fungicide afforded promising protection but frequently resulted in injury to the sprouting seeds, with a consequent reduction in stand; the injury was apparently associated with soil-borne fungous diseases, soil alkalinity, moisture conditions and the common use of ethylene dibromide as a soil fumigant for the control of wireworms and nematodes before planting. In 1950–52, the insecticides were mixed with a fungicide and applied as a seed coating, either dry or in a slurry, before sowing, or sprayed on the seeds, already coated with fungicide, as they were dropped from the planter. Sowing was at the rate of about 100 lb. per acre, and for the seed coatings, 0·25–0·5 oz. insecticide was applied per 100 lb. seed, with about 3·5 oz. fungicide concentrate in dry seed coatings and 2·5 oz. in the slurry treatments. In dry treatments, chlordane, aldrin, dieldrin, lindane and heptachlor gave good protection at 0·5 oz., and the last three were almost as effective at 0·25 oz.; p,p′methoxy-DDT (methoxychlor) gave poor protection at 0·5 oz. In slurry treatments, lindane, dieldrin and heptachlor were very effective and as good at 0·25 as at 0·5 oz.; aldrin at 0·25 oz. also gave good protection. Lindane tended to reduce the plant stand in several of the tests. In the spray treatments, aldrin, dieldrin, heptachlor and lindane were applied at 1·25–1·6 oz. per 100 lb. seed in wettable powders and chlordane at 6·4 oz. in an emulsion concentrate. All gave very good protection, there was no significant difference between spray rates of 10·5 and 16 U.S. gals. per 100 lb. seed when equal amounts of insecticide were applied, and spray treatments gave better plant stands than seed coatings, probably as a result of the additional moisture. Lindane and dieldrin tended to result in better stands than the other materials. Seed coating is considered the best method for adoption in practice.

In 1950, spray treatment of the seed with ethylene dibromide alone or with chlordane at 6·5 oz. or aldrin at 2 oz. was tested. All treatments gave satisfactory protection, but the plant stand decreased as the dosage of the dibromide in the mixtures was increased from 2 to 6 lb. per acre, though the highest rate alone was not injurious. In 1952, fumigation of the soil with 3 U.S. gals. 85 per cent. ethylene dibromide 12 days before sowing caused a reduction in stand that was not affected by seed treatment with sprays or slurries of aldrin, dieldrin, heptachlor or lindane.

GERHARDT (P. D.). **Chlordane, Dieldrin, Aldrin, and Heptachlor for Control of the Argentine Ant in California *Citrus* Orchards.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1063–1066, 12 refs. Menasha, Wis., 1954.

In tests in California in 1950–51, chlordane, dieldrin, aldrin, heptachlor and toxaphene in wettable-powder and emulsion sprays and the first three in dusts were compared for the control of *Iridomyrmex humilis* (Mayr) in *Citrus* orchards. The treatments were applied to the trunks, to branches that touched the ground and to the litter below the trees, the sprays usually in July–December and the dusts in November or December. Control is desirable as the ants interfere with the natural enemies of Coccids.

Wettable-powder sprays containing 1 lb. chlordane, dieldrin, aldrin or toxaphene per 100 U.S. gals. did not give satisfactory control on either lemon or orange, but were rather more effective on the former. At 2 lb. per 100 U.S. gals., chlordane and aldrin kept orange trees free from ants for three months, and dieldrin and heptachlor for four, whereas on lemon, heptachlor and dieldrin afforded protection for 7 and 2 months, respectively, toxaphene was ineffective, and trees sprayed with chlordane, aldrin

and dieldrin showed 43·8, 58·6 and 100 per cent. infestation after seven months.

In emulsion sprays containing 2 lb. toxicant per 100 U.S. gals., dieldrin and heptachlor kept orange trees free from ants for eight months, and aldrin and chlordane for three. On lemon, dieldrin gave almost complete protection for seven months, and chlordane was almost as effective; aldrin reduced the infestation to a low level for five months, heptachlor protected the trees for two months and toxaphene was ineffective.

On orange, dusts of 5 per cent. chlordane or 2 per cent. dieldrin eliminated infestation for three months and reduced it for a further five, whereas 2 per cent. aldrin eliminated it for one month only and permitted complete reinfestation in five months. All lemon trees were reinfested three months after treatment with these dusts, and it is concluded that they do not give practical control of *I. humilis* on *Citrus*. Reinfestation of treated groves normally occurred first at the borders, especially in plantings adjacent to uncultivated land.

Sherman (M.) & Rosenberg (M. M.). **Acute Toxicity of four Chlorinated Dimethanonaphthalene Insecticides to Chicks.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1067–1070, 7 refs. Menasha, Wis., 1954.

The authors review the literature on the toxicity of chlorinated-hydrocarbon insecticides to poultry [*cf. R.A.E.*, A **40** 121, 177, 178, 401; **42** 75] and give the results of tests in which aldrin, dieldrin, isodrin and endrin [*cf.* **41** 268, note] were fed in measured doses in capsules to New Hampshire chickens 7–64 days old and the birds were observed for a week. The median lethal doses of the four insecticides to chicks a week old were 25·5, 43, 2·7 and 3·5 mg. per kg. body weight, respectively. The results for the first two were not in accordance with those of other workers [**40** 121, 177]. Resistance to the insecticides increased with age, the increase being greater for dieldrin and endrin than for aldrin and isodrin, for which it was slight. The weight gains of the survivors showed few significant differences due to treatment. Endrin appeared to be stored more readily than isodrin in both the fat and liver tissues. The symptoms of poisoning produced are described; aldrin and isodrin caused considerably more excitation than dieldrin or endrin.

Cressman (A. W.), Broadbent (B. M.) & Munger (F.). **Some Factors influencing the Effectiveness of Parathion against California Red Scale.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1071–1074, 6 refs. Menasha, Wis., 1954.

The following is based on the authors' summary. Natural factors that are important in the efficient use of parathion, alone or combined with oil, for the control of *Aonidiella aurantii* (Mask.) on *Citrus* were investigated in the field and laboratory in California in 1948–52 [*cf. R.A.E.*, A **39** 165], parathion being used in a wettable powder. Mortality of the scale after field sprays of 6–8 oz. actual parathion per 100 U.S. gals. was lowest on the fruit, highest on the grey wood and intermediate on the green twigs, but the kills from sprays of 2–4 oz. parathion with 1–1·8 U.S. gals. oil per 100 U.S. gals. were nearly equal on all parts of the tree. Density of infestation had no effect on the mortality given by 4–8 oz. parathion per 100 U.S. gals.; sprays of 2 oz. parathion and 1·5 per cent. oil or 3 oz. parathion and 1 per cent. oil showed some decrease in kill at very high levels of infestation but little or none within the range of scale density

usually encountered. Differences in temperature after spraying had no effect on the final kill after treatment with 4·8 oz. parathion per 100 U.S. gals. when the scales were reared under uniform conditions up to the time of spraying in the laboratory, but death occurred more rapidly at high temperatures.

Stone (M. W.) & Foley (F. B.). **Field Experiments with Insecticides for the Control of Wireworms in irrigated Lands.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1075–1083, 2 figs., 3 refs. Menasha, Wis., 1954.

The following is substantially the authors' summary. Experiments were carried out in lima-bean fields in California in 1946–53 to determine the effectiveness of several chlorinated-hydrocarbon insecticides against *Limonius californicus* (Mannh.). The insecticides were applied as dusts or sprays to the soil surface and mixed with the soil by double disking or with a spring-toothed harrow.

DDT at 10 and 20 lb. per acre, applied 6–8 weeks before sowing, gave excellent control for four and five years, respectively, and BHC at 0·5 lb. γ isomer and lindane [almost pure γ BHC] at 0·5 lb. per acre were very effective initially and afforded control for three years. Chlordane and heptachlor at 10 lb. per acre, applied 34–81 days before sowing, had given exceptionally good control of *L. californicus* for three years at the time of writing, and the former was also highly effective against *Melanotus longulus* (Lec.), a wireworm that is not adequately controlled by DDT. Heptachlor at 5 lb. per acre, applied 34 days before sowing, controlled *L. californicus* for two years, after which the experiment was terminated. Dieldrin applied at 1–2 lb. per acre 34–81 days before sowing in a field with a low initial infestation was still giving control at the end of three years, but aldrin, applied at 2 lb. per acre four months before planting gave only partial control in the first year and was inadequate in the second and third; the poor results with this material may have been due to the use of a spring-toothed cultivator rather than double disking. In one test, p,p′ methoxy-DDT (methoxychlor) at 10 lb. per acre proved ineffective, and in another, carried out by J. Wilcox in 1947, *L. californicus* was well controlled by foliage applications of 10 per cent. DDT dust against the fruitworm [*Heliothis armigera* (Hb.)] on tomato and the ploughing under of the crop residues.

Howe (W. L.) & Campbell (W. V.). **Susceptibility of different larval Instars of the Green June Beetle to Aldrin-treated Soil.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1084, 2 refs. Menasha, Wis., 1954.

In view of the results obtained in tests with aldrin against larvae of *Cotinis nitida* (L.) in Virginia [*R.A.E.*, A **42** 151], the susceptibility of larvae in the three instars to that insecticide was studied in the insectary in 1952. The larvae were introduced into boxes containing 3 ins. slightly moist sandy-loam soil that had been treated with aldrin at 0·25–4 lb. per acre, kept at temperatures approximating to those in the field and examined every five days. All the first-instar larvae died within five days at the lowest dosage, and all those in the second instar were dead or moribund after five days in soil treated with 2 lb. aldrin per acre, whereas complete kills of the third instar were obtained only after exposure to the 4-lb. dosage for 20 days, though 2 lb. resulted in 91 per cent. dead or moribund in ten days and 96 per cent. in 20 days. Comparison of the median lethal doses obtained from dosage-mortality curves showed that larvae in the first

instar were five and ten times as susceptible to aldrin as those in the the second and third instars, respectively. Some second-instar larvae were killed during moulting, 7–10 days after introduction, indicating a greater susceptibility at that time. Little further mortality occurred after 20 days among the few larvae surviving exposure to 0·25 or 0·5 lb. aldrin, possibly owing to loss of toxicant and increased larval age. The high susceptibility of the first-instar larvae to low dosages of aldrin explains the excellent control given by applications made before the eggs hatch [*cf. loc. cit.*].

Lienk (S. E.) & Chapman (P. J.). **Evaluation of Acaricides on Orchard Mites in 1952.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1085–1086, 2 refs. Menasha, Wis., 1954.

In the tests described, which were carried out in apple orchards in New York, all spray quantities are given per 100 U.S. gals. Sprays of 8 fl. oz. 20 per cent. TEPP [tetraethyl pyrophosphate], applied for the control of *Paratetranychus pilosus* (C. & F.) (*Metatetranychus ulmi*, auct.) at the pink stage, calyx stage or both, resulted in 2, 7 and 1 hatched mites per leaf, respectively, as compared with 236 for no treatment, in 1950, when there were 16 days between the beginning of hatching and the calyx spray, 30, 67 and 3 as compared with 167 in 1951, when there were 20 days, and 3, 10 and 2 as compared with 53 in 1952, when there were 26 days, and it is concluded that the lack of a close relation between mite and tree development limits the effectiveness of materials with such short residual action and little or no toxicity to the eggs. Most acaricides tested gave better results when applied at the pink than at the calyx stage in all three years [*cf. R.A.E.*, A **39** 333].

In 1952, infestation by *P. pilosus* reached its peak on untreated trees on 21st July, when there were 527 mites per ten leaves. This number was reduced to 15 by 2 per cent. oil at the delayed-dormant stage, 62, 10, 8 and 6 by 4 fl. oz. 32 per cent. demeton (diethyl 2-(ethylmercapto)ethyl thiophosphate) at the delayed-dormant, pink, calyx, and pink and calyx stages, respectively, 18, 13 and 13 by 16 fl. oz. of an emulsion concentrate containing 25 per cent. 2-hydroxy-2,2-bis(p-chlorophenyl)-ethyl acetate [also known as ethyl ester of 4,4′-dichlorobenzilic acid (**41** 300)] at the pink stage, calyx stage and both, 9, 6 and 9 by 1 lb. 15 per cent. wettable parathion on the same dates, 13, 10 and 10 by 2 lb. of the wettable parathion in the calyx spray, ten-day spray and both, and 31 by 1 lb. 50 per cent. wettable Ovotran [p-chlorophenyl p-chlorobenzenesulphonate] at the calyx stage. Some of these treatments, and particularly the last, permitted reinfestation towards the end of July.

When sprays were applied on 4th July against a heavy infestation of *P. pilosus*, well over 90 per cent. control was given in three days by 1 U.S. pint of a 50 per cent. malathion emulsion concentrate, 2 fl. oz. 42 per cent. demeton, 1 U.S. pint 25 per cent. emulsion concentrate of the acetate previously used, bis(p-chlorophenyl)-ethoxy-methylcarbinol, O,O-diethyl O-(2-isopropyl-4-methyl-pyrimidyl(6)) thiophosphate, O,O-diethyl O-(3-methyl-pyrazolyl(5)) thiophosphate or diethyl 3-methyl-pyrazolyl(5) phosphate [*cf.* **41** 399], 2 lb. 25 per cent. wettable malathion, 2 lb. 25 per cent. wettable NPD (tetra-n-propyl dithionopyrophosphate), 1 lb. 15 per cent. wettable parathion, 3 lb. 50 per cent. wettable Sulphenone [p-chlorophenyl phenyl sulphone] or 1·5 lb. 15 per cent. wettable Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], and all maintained very good control for at least 17 days; two fungicides, Tag (10 per cent. phenyl mercuric acetate) and Crag (34 per cent. 2-heptadecyl glyoxalidine acetate),

applied at 0·5 U.S. pint and 2 U.S. pints with 3 lb. lime, respectively, gave high initial control but permitted apparently complete reinfestation in 17 days. The same treatments, with the exception of the fungicides and the carbinol and the addition of 2 lb. 15 per cent. parathion and the Aramite spray with 3 lb. hydrated lime, all gave almost complete control of *Tetranychus bimaculatus* (Harvey) for at least 31 days when applied on 11th August and were as effective as when applied on both 11th and 21st August. The efficiency of Aramite was not affected by the presence of the lime. A spray of 2 lb. 50 per cent. wettable DDD gave rather poor results after one application, but was more effective after two.

Reddy (D. B.) & Michelbacher (A. E.). **Preliminary Tests with DDT Paint.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1087–1088, 1 ref. Menasha, Wis., 1954.

The use of paints containing DDT for insect control in granaries may be limited or prohibited for fear of food contamination, but there are possibilities of using them for the ceilings and outside walls of houses, granaries and warehouses. In tests, an oil-type paint containing 2·5 per cent. DDT was used to paint the insides of cartons, and adults of *Calandra* (*Sitophilus*) *oryzae* (L.) and *Tribolium confusum* Duv., not more than six weeks old, were confined in these for 48 hours at 20–24°C. [68–75·2°F.] and 45–60 per cent. relative humidity, after which the survivors were transferred to clean bottles containing food and examined daily. Adults of *C. oryzae* all died in three days when exposed to the treated surface immediately it had dried and in nine days when the surface had been treated 14 weeks before. Mortality of males began during the exposure period and was complete in seven days, whereas that of females did not begin until two days after exposure and was complete in nine days. Adults of *T. confusum* all died in five days when they were exposed immediately or one week after the paint had dried and in nine days when they were exposed after ten weeks. Exposure for less than 48 hours had no appreciable effect except immediately and one week after painting.

Wolfe (H. R.) & Anthon (E. W.). **Transmission of the Western X-Disease Virus from Sweet and Sour Cherry to Peach by two Species of Leafhoppers.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1090–1092, 4 refs. Menasha, Wis., 1954.

The virus that causes western X-disease of peach [*cf. R.A.E.*, A **39** 399] has been transmitted from infected to healthy peach by *Colladonus geminatus* (Van D.) in Oregon, Washington and Utah [*cf. loc. cit.*] and also by *Fieberiella florii* (Stål), *Scaphytopius acutus* (Say) and *Keonolla confluens* (Uhl.) in Washington, from infected sweet and sour cherry (in which it causes the disease referred to as western-X-little-cherry) and choke cherry [*Prunus virginiana*] to peach by *C. geminatus* in Utah, and from infected sweet cherry to peach by *F. florii* in Washington. In the tests described, it was transmitted from sweet and sour cherry to peach by *C. geminatus* and *S. acutus* in Washington. When the Jassids fed on the source of the virus for 8–65 days and on the test trees for 4–79 days, four transmissions by 1–50 adults of *C. geminatus* and five by single adults of *S. acutus* were obtained in 21 and ten tests, respectively, from infected sweet cherry and five with 1–25 *C. geminatus* in 15 tests from infected sour cherry; in two of the last series, the insects acquired the virus while in the nymphal stage. When adults of *S. acutus* that had fed on infected sour

cherry for 35 days were allowed to feed singly on healthy peach seedlings and transferred to further healthy seedlings every ten days for as long as the insects survived, eight of 15 transmitted the virus; four did so before being transferred from the first test plant in the series, indicating that the latent period of the virus in these insects was not more than 45 days, and one infected three plants in succession. The other three infected the third test plant only.

In these tests, the first symptoms appeared 60 days after exposure in most of the greenhouse plants, but six trees did not show symptoms until 60 days after they had undergone a dormant period of 90 days at 35°F. A test tree in the field did not show symptoms until about a year after feeding by the insects.

Pagán (C.) & Morris (M. P.). **A Comparison of the Toxicity of Mamey Seed Extract and Rotenone.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1092–1093, 9 refs. Menasha, Wis., 1954.

In tests in Porto Rico to compare the toxicity of extracts of the seed of *Mammea americana* with that of rotenone from derris root, the powdered mamey seed was soaked in chloroform for 48 hours, which extracted about 5 per cent. of the weight of the dry seed, including all toxic materials, the chloroform was evaporated, and the residue was weighed and dissolved in alcohol. The rotenone was also dissolved in alcohol, and both were tested against guppies [*Lebistes reticulatus*] in the laboratory [*cf. R.A.E.*, A **38** 64]. Preliminary tests indicated differences in mode of action between the two poisons; the effect of mamey extract, the toxic components of which had been shown to be weak phenolic acids, was similar to that of phenols on goldfish.

The thresholds of toxicity of the mamey extract and rotenone were found to be 1·3 and 0·02 mg. per litre, respectively, and the median lethal doses 1·7 mg., representing 30 mg. seed, and 0·05 mg., equivalent to 0·5 mg. derris root. Rotenone is therefore about 30 times as toxic as mamey extract to the fish, and derris root about 60 times as toxic as mamey seed. The slope of the dosage-mortality curve was steeper for mamey than for rotenone, showing that once the toxic threshold was reached, a relatively small addition of poison gave complete kill.

The active ingredients in the crude mamey extract were separated by columnar chromatography. Two toxic and four non-toxic zones were formed on the column. The lower toxic zone contained two crystalline compounds with a median lethal dose to guppies of 1·5 mg. per litre, and the upper one an amorphous solid with a median lethal dose of 0·25 mg.

In view of the difficulty of cultivating mamey and the low toxicity of the seeds shown in these tests, it is unlikely to become a commercial insecticide.

Rohwer (G. G.). **White-fringed Beetle Surveys in noninfested States.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1094–1095, 1 ref. Menasha, Wis., 1954.

Species of *Graphognathus* (white-fringed beetles) are known to occur in small portions of eight States in the south-eastern United States [*cf. R.A.E.*, A **41** 91], but as they are believed to have a potential range from the lower end of the Florida Peninsula (annual isotherm of 70°F.) to the latitude of Philadelphia, Pennsylvania (57°F.) or possibly further, surveys for them should not be restricted to the known infested areas. The

bionomics of the beetles [*loc. cit.*] and methods of survey are briefly described. The best method in infested States is to watch for the characteristic injury caused to the plants by the larvae and then examine soil samples by hand. In States not known to be infested, the most rapid and effective method is inspection for the adults. These make a characteristic feeding pattern on the leaves, and can usually be found on the ground under or near the plants they have damaged.

Graphognathus spp. are distributed with nursery stock and by the movement of agricultural products and industrial supplies along roads and railways, and inspections in non-infested States should be based on the probable avenues of spread from the south-eastern States and possible importations directly from South America.

Laudani (H.) & Patterson (W. J.). **Effect of Wear and Aging on Residues of DDT used to prevent Insect Damage to woolen Rugs.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1095–1096, 4 refs. Menasha, Wis., 1954.

DDT has been widely used for the protection of woollen rugs against insects, but since wool has no affinity for DDT, the insecticide is subject to removal by wear and vacuum cleaning. Tests were therefore carried out to determine the rate of insecticide loss due to these factors. A woollen rug weighing 4·1 lb. per sq. yard was sprayed on the upper surface with a 5 per cent. solution of DDT in deodorised kerosene at the rate of about 0·5 per cent. DDT by weight of the rug, a compressed-air hand sprayer and a pressure of 20 lb. per square inch being used. One day after treatment, the rug was placed in such a position that half of it was exposed to heavy walking traffic, and the other half received only occasional use. The first half was subjected to vacuum cleaning once a week, and samples were removed from both sections after 1–18 months for chemical and biological tests. The results showed that after 18 months, the original DDT deposit of 0·49 per cent. was reduced to 0·4 per cent. by light wear and to 0·07 per cent. by hard wear and cleaning. No mortality occurred throughout the period among larvae of the black carpet beetle [*Attagenus piceus* (Ol.)] confined with samples for 28 days at temperatures of 78–82°F. and 55–65 per cent. relative humidity, but the treatment prevented damage by them for the entire 18 months on the section exposed to light wear, and permitted only very light to light injury on that exposed to heavy wear.

Since insect damage to rugs usually occurs along the edges and on sections that are seldom exposed to wear, it is concluded that DDT applied at the rate of 0·5 per cent. by weight of the material will protect woollen rugs for at least 18 months under most conditions.

Cory (E. N.), Haviland (E. E.) & Atcheson (W. C.). **Injury to Cattleyas by an Eriophyid Mite.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1096–1097. Menasha, Wis., 1954.

Injury to orchids of the genus *Cattleya* in a greenhouse in Maryland, comprising small brown areas just above the line of the sheath and a dark brown or black discoloration of the sheath itself, was found to be associated with infestation by an Eriophyid of the genus *Aceria*. The mites congregated and fed under the sheath on young pseudobulbs, apparently taking advantage of the contact afforded by the sheath; when numerous, they sometimes gathered at the tip of a leaf or the developing pseudobulb, and this may be connected with dispersal. The egg and larval stages lasted for

averages of 5·6 and 4·9 days, the feeding and active period of the protonymphs for 5·5 days, and the deutonymphal period for 7·5 days. The adults survived for an average of 20 days. A spray of Triton X-100 diluted 1 : 240 in water controlled the mites, and one of lime-sulphur killed over 50 per cent.

Hoerner (J. L.). **Soil Treatment Tests for Control of the Pale Western Cutworm.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1097. Menasha, Wis., 1954.

In the spring of 1951, moderate numbers of larvae of *Agrotis orthogonia* Morr. occurred in non-irrigated wheat fields in Colorado. In tests against them, in late April, a low-pressure sprayer was used to apply various emulsion sprays to plots, after which the soil was treated with a spike-toothed harrow or tine weeder or left undisturbed. Examination of 50 or more larvae dug from the top soil in each plot a week later showed that DDD applied at 1·5 lb. in 13 U.S. gals. spray per acre, or at 1 lb. in 7 U.S. gals., and dieldrin and aldrin at 8 oz. in 7 or 13 U.S. gals. gave practical control, proving least effective where the soil had remained undisturbed, whereas toxaphene at 3 lb. in 25 U.S. gals. or at 2 or 4 lb. in 13 U.S. gals., DDT at 2 lb. in 7 or 13 U.S. gals. and chlordane at 1·5 lb. in 7 or 13 U.S. gals. were less toxic. DDD and DDT, applied at 2 lb. 50 per cent. wettable powder per acre in fertiliser applicator, were of no value. The grower treated parts of several fields with aldrin and obtained satisfactory results; in one, in which 0·38 inch rain fell before the soil could be harrowed, control was as good as in others that had been harrowed. Areas in which all the wheat had been killed were resown with barley seed mixed with 2 lb. 50 per cent. wettable DDD or DDT per acre, which resulted in a fair stand, whereas when oats were sown without insecticide in bare spaces in an adjoining field all the plants were killed.

In 1952, emulsion sprays were again applied. Treatment with dieldrin and heptachlor at 8 oz. and with γ BHC as lindane at 4 and 8 oz. in 8 U.S. gals. spray per acre in late April, without subsequent harrowing, but followed by rain within a few hours, gave 87·9, 80·5, 45·7 and 59·3 per cent. mortality of larvae in the fourth or fifth instar 8–15 days later, and treatment in mid-May with 2 lb. DDD or 8 oz. dieldrin in 8 U.S. gals. spray per acre, followed by harrowing and light rain, gave 80 and 96 per cent. mortality in six days and 94 and 99 per cent. in 15 days in a field in which barley had been completely destroyed by larvae in the sixth and seventh instars.

Reddy (D. B.) & Michelbacher (A. E.). **Nature of Food and its Influence on Rice Weevil.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1098, 4 refs. Menasha, Wis., 1954.

Several workers have reported differences in the size and weight of adults of *Calandra* (*Sitophilus*) *oryzae* (L.) reared on different foods [*cf. R.A.E.*, A **29** 172; **33** 361; **34** 21], and as the senior author observed that adults reared on wheat were larger and heavier than those fed on maize, experiments were carried out on the influence of food quality on the weight of the adult weevils.

Equal-sized kernels of wheat were left untreated or boiled in water for an hour and allowed to dry, after which both lots were brought into equilibrium with 70 per cent. relative humidity; this resulted in moisture contents of 13·6 and 12·2 per cent., respectively. Females were kept in

samples of each for two days at a constant temperature of 26·6°C. [79·88°F.] and then removed, and the wheat in each culture was replaced with corresponding wheat one week after the emergence of their progeny, and every two weeks thereafter. Weevils that emerged from raw and boiled wheat were weighed separately in samples of 75 at intervals for four months.

The moisture content of the raw wheat was the more favourable for development, and the weevils emerged in 30 days from it and in 33 from the boiled wheat, but adults from boiled wheat were heavier than those from raw wheat (1·35–1·42 and 1·17–1·24 mg., respectively). The greater weight of the weevils from the boiled wheat was probably due to changes in the physical or chemical nature of the wheat and the availability of nutrients.

Kaloostian (G. H.). *Tomosvaryella lepidipes*—**a Parasite of the Geminate Leafhopper.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1098–1099, 1 ref. Menasha, Wis., 1954.

Puparia found in a cage containing adults of the Jassid, *Colladonus geminatus* (Van D.) that had been collected in Utah in the autumn of 1952 and were being used in experiments on the transmission of the virus that causes western X-disease of peach and other plants gave rise three months later to adults identified as *Tömösváryella lepidipes* Hardy. This Pipunculid is a fairly common parasite of the Jassid in the later summer, and parasitised adults cannot be distinguished on collection. It occurs widely in the United States and also in western Canada, but no hosts have previously been recorded for it.

Ballard (R. C.). **A Modification of the Huffaker Cage for confining Mites or small Insects.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1099, 2 refs. Menasha, Wis., 1954.

As mites of the genus *Typhlodromus* readily escape from the cage for small insects described by Huffaker [*R.A.E.*, A **37** 471], a modification was devised that proved satisfactory. Two alternate layers of blotting paper and cellulose cotton were put on a smooth water-proofed surface of masonite and covered with a newly picked bean leaf. A piece of transparent plastic having a small hole with the sides bevelled to an angle of about 60° drilled in it was put over the leaf, a ring of agar being used to seal all openings between plastic and leaf, and another piece of plastic, about 5 mm. larger in size than the hole, was clipped over it. Two or more cells were made in the same piece of plastic. The cotton and blotting paper were thoroughly moistened before the parts were assembled, and the moisture content was maintained by periodically damping the edges of the cage and injecting water with a lumbar-puncture needle; by this technique, a green leaf could be kept in a normal state for 3–4 weeks.

Griswold (C. L.). **Transmission of the Oak Wilt Fungus by the Pomace Fly.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1099–1100. Menasha, Wis., 1954.

In a test in Ohio in 1953 on the ability of *Drosophila melanogaster* Mg. to transmit *Endoconidiophora fagacearum*, the fungus that causes oak wilt [*cf. R.A.E.*, A **42** 99–100], a red-oak seedling two years old was artificially wounded several times and caged with partly closed culture dishes containing about 200 adults of *D. melanogaster* Mg. and sporulating mats of

the fungus. The flies had been attracted to the mats and had fed and oviposited on them for 2–24 hours before use, and they were subsequently observed to feed both on the fungus and at the wounds on the seedling. Oviposition continued in the cages until the flies died, about a week later, when the fungus mats were sodden from the feeding of their progeny. Typical foliar symptoms of oak wilt were observed about six weeks after the last exposure, and the seedling died soon after. *E. fagacearum* was cultured from the stem and root.

Stone (M. W.). **Sugar-beet Wireworm predaceous on Seed-corn Maggot.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1100, 2 refs. Menasha, Wis., 1954.

The recent widespread use of soil insecticides for the control of *Limonius californicus* (Mannh.) in lima-bean fields in southern California has been accompanied by a noticeable increase in populations of *Hylemyia cilicrura* (Rond.) and in damage by the larvae to the sprouting beans. In June 1946, the cotyledons were severely attacked by *H. cilicrura* in a field that had been fumigated for control of the wireworms six days before sowing, and soil sampling showed the presence of an average of 3·1 larvae and pupae of *Hylemyia* per foot of row but no wireworms, whereas an adjacent untreated field contained damaged or dying plants with wireworms in the stems but only occasional plants injured by *Hylemyia*.

It had already been suspected that the wireworm was predacious on the larvae of *Hylemyia*; both feed in the sprouting beans and tunnel in the underground portions of the stems, and the maggots would therefore be vulnerable to attack. When larvae or pupae of *Hylemyia* were confined with equal numbers of wireworms in cans containing moist soil, with lima beans for food, only 15 per cent. of them were alive after 13 days, as compared with complete survival in cans containing no wireworms. Although the wireworms were not seen attacking *Hylemyia*, these results indicate that they are predacious on it.

Schopp (R.). **Occurrence of the Vetch Bruchid in Lentil Seed.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1100. Menasha, Wis., 1954.

The vetch Bruchid, *Bruchus brachialis* Fhs., is widely distributed over an area of about 15,000 acres in Washington and Idaho where lentils are grown, and a very small percentage of the seeds was infested by it in 1951. It was not found in the seeds in 1952, and adults were swept only from parts of the fields where self-sown vetch was growing. They did not occur on lentil plants even though they were numerous on neighbouring patches of vetch. The infestation of the lentil seeds in 1951 is attributed to a weed-control programme as a result of which the Bruchids were deprived of vetch pods for oviposition.

Gyrisco (G. G.) & Muka (A. A.). *Miccotrogus picirostris* (**Fab.**) **found on Red Clover in New York.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1100–1101, 1 ref. Menasha, Wis., 1954.

The clover weevil, *Miccotrogus* (*Tychius*) *picirostris* (F.), has not been reliably recorded east of Ohio in the United States, although it has been taken from alsike clover [*Trifolium hybridum*] in Ontario in areas just north of parts of New York. A record in 1923 [*R.A.E.*, A **12** 86] is believed to refer to *Tychius stephensi* Schönh., which was formerly confused with *M. picirostris*.

In the summer of 1952, an intensive search was made on alsike clover and medium red clover in the areas of New York nearest to those of known infestation, and both *M. picirostris* and *T. stephensi* were readily taken in sweeps and hand collections from red-clover flowers in Oswego County during August. It is not known whether *M. picirostris* was actually feeding on the clover.

Rawlins (W. A.). **A Method for rearing the Onion Maggot in Insectary Cultures.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1101. Menasha, Wis., 1954.

In the method described, which was developed for the maintenance of laboratory cultures of *Hylemyia antiqua* (Mg.), adults are kept in cages of fine-mesh cloth containing honey and brewers' yeast, on which they feed, and onion sets planted in moist shallow soil. Eggs are laid in abundance round the small bulbs and between the loose scales, and the soil containing them is transferred to 10-inch pots, large onion bulbs being placed on the surface as food for the larvae. When the latter have pupated, the soil is washed through a 16-mesh wire cloth, which retains the puparia and débris, and these are separated by flotation. The puparia are placed on a clay platter covered with vermiculite and kept until the adults emerge. Various flowers and honey alone did not provide sufficient nutriment for normal oviposition.

Bennett (S. E.) & Fulton (B. B.). **The seasonal Cycle of the Strawberry Rootworm, *Paria canella* (Fabr.) in North Carolina.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1101–1102, 1 ref. Menasha, Wis., 1954.

Paria canella (F.) (strawberry rootworm) has one generation a year in California and only females are known there [*cf. R.A.E.*, A **39** 451]. In view of doubt as to the number of generations in North Carolina, investigations were carried out from October 1950 to December 1951 and in the summer of 1952. It was known that the adults emerged from hibernation in spring and increased in numbers about mid-July. In laboratory investigations, they were kept in covered dishes with strawberry leaves for food, and eggs were deposited between leaves and glass or between pairs of glass slides. The larvae were reared in the same dishes on strawberry leaves and removed to moist soil when about to pupate. It was found in this way that there was one complete generation and a partial second in the year. Oviposition began on 17th April 1951 and continued until mid-July, reaching a peak in late May and early June. Larvae were present from 25th April until 12th September, being most abundant in late June, and pupae from about mid-June until September. The egg stage, the four larval instars and the pupal stage averaged 7·8, 11·3, 10·3, 12·6, 13·3 and 7·8 days, respectively. Adults of the first generation emerged from mid-July onwards and were most numerous at the end of that month. Some laid eggs, and larvae from these that were caged on potted strawberry plants outdoors had pupated by December. One female of the second generation was reared to maturity in the laboratory between 6th August and 19th October 1951; it survived in isolation until 30th May 1952, depositing eggs about 22nd May; these hatched by 30th May, demonstrating the occurrence of parthenogenesis.

In investigations in the summer of 1952 on the probable size of the second generation, about 130 beetles were collected in July, after the midsummer increase. Of 100 that were dissected, four were males and 72 of the females

contained eggs, and of another 25, 17 oviposited within six days. If these represent the normal proportion giving rise to a second generation, it is surprising that more damage by larvae has not been observed on strawberry in late summer. Most of the injury has been attributed to feeding by the adults, as even where this is severe it is often difficult to find larvae or root injury.

Boudreaux (H. B.). **A simple Method of collecting Spider Mites.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1102–1103. Menasha, Wis., 1954.

Tetranychid mites can be expeditiously collected by beating plant material on a screen fastened over the large end of a funnel. The mites that pass through fall into a suitable container supported below the narrow end. Tapping the funnel after beating the leaves dislodges most of the mites clinging to it.

DeBach (P.). **The Establishment in California of an oriental Strain of *Prospaltella perniciosi* Tower on the California Red Scale.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1103, 1 ref. Menasha, Wis., 1954.

A species of *Prospaltella*, later considered to be morphologically indistinguishable from *P. perniciosi* Tower, was introduced into California in 1949 with parasitised material from Formosa or China and found to develop readily on *Aonidiella aurantii* (Mask.). It was liberated throughout the *Citrus* areas infested by that Coccid in southern California, and had become established in certain groves by 1951 [*cf. R.A.E.*, A **39** 182]. Observations in study plots in 1953 showed that the parasite had maintained itself successfully under both coastal and inland conditions, in spite of competition from well-established natural populations and periodic releases of large numbers of *Aphytis*. *P. perniciosi* appears likely to become a valuable adjunct to *Aphytis* in the control of *Aonidiella* and to be more important than the Chinese strain of *Comperiella bifasciata* How. [*cf. loc. cit.*] where the two coexist. In one plot in the interior, in which each tree received 4,000 examples of *Aphytis* A [*cf.* **39** 235] each year, *Prospaltella* maintained itself and was the dominant parasite in the late winter and early spring of 1952 and 1953; *Aphytis* populations are generally at their lowest at that time, owing to the unfavourable weather. The success of *P. perniciosi* illustrates the importance of introducing and colonising all the available natural enemies of a pest, regardless of their taxonomic standing or importance in the country of origin.

McGarr (R. L.). **Combinations of Insecticides for Control of the Pink Bollworm and other Cotton Insects in the Lower Rio Grande Valley.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1103–1105. Menasha, Wis., 1954.

Infestation of cotton by *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) and *Anthonomus grandis* Boh. was severe in the Lower Rio Grande Valley of Texas in 1952, and combined sprays were tested for their control. DDT was used with methyl-parathion or Metacide [methyl-parathion with a smaller quantity of parathion] in emulsion sprays applied at about 5 U.S. gals. per acre. Methyl-parathion and Metacide were applied at about 0·2–0·375 lb. per acre, the lowest dosage being used early in the season, when the plants were small, and sufficient DDT was added to give about 1 lb. per acre in the first three sprays and 1·5 lb. thereafter. Enough dieldrin to give 0·375 lb. per acre was added in the last one or two applications to some

plots for the control of migrating adults of *A. grandis*. Treatments were begun during the first week of blooming, when 10 per cent. or more of the flowers were infested by *P. gossypiella*, and repeated at about weekly intervals until the crop matured, except for a break of two weeks after the third effective application; 3–11 applications were made in all between 15th April and 3rd July.

The methyl-parathion and Metacide sprays reduced the average percentage of bolls infested by *Platyedra* from 61·2 to 15·7 and 14·9, and the average number of larvae per infested boll from 3 to 1·4 and 1·5, respectively, and were effective against *A. grandis* until migration began, when sprays containing dieldrin gave good control. Both mixtures also controlled *Aphis gossypii* Glov., *Heliothis armigera* (Hb.), *Alabama argillacea* (Hb.) and Tetranychid mites, and increased the yield to almost twice that from untreated plots; the gains are attributed in about equal proportions to the control of *Platyedra* and of *Anthonomus*. It is concluded that both methyl-parathion and Metacide are promising, but that the former would probably be preferable as it is a little more effective against *Anthonomus*.

Eden (W. G.). **Control of Rice Weevil in Corn with protectant Dusts and Sprays.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1105–1107, 5 refs. Menasha, Wis., 1954.

In tests in Alabama, unhusked, husked and shelled maize was dusted with a mixture containing 0·05 per cent. pyrethrins and 0·8 per cent. piperonyl butoxide (Pyrenone Grain Protectant) at rates of 1 lb. dust per 8, 10 or 16 bushels, respectively, in 1951, and of 1 lb. per 10 bushels in 1952, and stored for nine months with untreated maize infested by *Calandra* (*Sitophilus*) *oryzae* (L.). The average percentage of kernels damaged before treatment was 5 in 1951 and 5·2 in 1952, and the moisture content of the grain was estimated at 10 per cent. in 1951 and found to average 9·7 per cent. in 1952. The average percentages of kernels damaged during storage were combined for the two years; in untreated and treated grain, respectively, they were 37·73 and 25·1 for unhusked maize, 71·26 and 20·76 for husked maize, and 86·09 and 13·14 for shelled maize.

In a further test in 1952, unhusked and husked maize was treated with various sprays containing mixtures of piperonyl butoxide and pyrethrins (approximately 10:1) or piperonyl butoxide and allethrin (5:1) and stored for eight months. None of the treatments afforded protection from *C. oryzae*.

Keen (F. P.). **Correction of Identity of the Douglas-fir Cone Moth.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1107–1108, 9 refs. Menasha, Wis., 1954.

The literature on the nomenclature and identity of moths of which the larvae have been recorded as infesting the cones of Douglas fir (*Pseudotsuga taxifolia*) in California, Oregon, Washington and British Columbia is reviewed. The species considered are *Barbara* (*Evetria*) *colfaxiana* (Kearfott) with its varieties *taxifoliella* (Busck) and *coloradensis* (Heinr.), *B. ulteriorana* (Heinr.), which is also possibly a variety of it, and *Enarmonia* (*Zeiraphera*) *griseana* (Hb.), of which *E. diniana* (Gn.) and *E.* (*Cydia*) *pseudotsugana* (Kearfott) are synonyms. The genus *Barbara* was erected by Heinrich for those of the species previously included in *Rhyacionia* (*Evetria*, auct.) that infest fir cones, and it is concluded that records of *diniana* and *pseudotsugana* from cones of Douglas fir in the American literature are all erroneous and are due to misidentification of one or other of the varieties

of *B. colfaxiana*. *E. griseana* is a defoliatior of Douglas fir and, in Europe, of white fir [*Abies*] and larch, and it defoliated about 90,000 acres of larch and white fir in Washington in 1949.

HALL (I. M.). **The Role of Virus Diseases in the Control of the Alfalfa Looper.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1110–1111, 2 refs. Menasha, Wis., 1954.

Plusia (*Autographa*) *californica* Speyer is widely distributed on lucerne in California but has recently been of little economic importance [*cf. R.A.E.*, A **42** 102]. Two virus diseases have been reported from the larvae, and collections made in the spring of 1953 from lucerne fields in various parts of southern California, in which population levels were low (1–2 larvae per ten sweeps of the net), showed the occurrence of a polyhedral virus and a granulosis virus. Both were found in larvae from four of the six fields examined and each in one of the other two, but in no case were both present in the same larva. The high proportion of infection indicated the ability of the diseases to control the insect at low host densities, and their effectiveness, in conjunction with that of insect enemies [*cf. loc. cit.*], may explain why *P. californica* is rarely a serious pest.

KAUFFMAN (W.) & STEVENSON (W. A.). **Value of early-season Control of Thrips on Cotton in the Santa Cruz Valley of Arizona.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1111–1112. Menasha, Wis., 1954.

Observations on cotton in Arizona showed that plant growth was retarded for several weeks after the seedlings appeared above ground, and this resulted in loss of crop in a year of early autumn frosts. Experiments were therefore carried out to ascertain whether early control of thrips, which infest the young plants, would cause the cotton to mature sooner. Plots received an early application only, late applications only or both. In 1950, a dust containing 5 per cent. DDT and 75 per cent. sulphur was applied at 10 lb. per acre when the plants had 2–4 leaves, followed later in the season by three applications of one of 10 per cent. DDT with 75 per cent. sulphur at 15 lb. per acre, principally for the control of *Heliothis armigera* (Hb.). In 1951, a 10 per cent. toxaphene dust was applied at 10 lb. per acre when the plants were slightly less advanced in growth than in the previous year, followed by three later treatments with 10 per cent. DDT dust at 15 lb. per acre against *Laphygma exigua* (Hb.) and *H. armigera*. In 1952, sprays of 2 oz. dieldrin or 1 lb. toxaphene in 2 U.S. gals. water per acre were applied soon after the true leaves began to form, followed by two later applications of 15 lb. 20 per cent. toxaphene dust against *H. armigera*.

Counts made each year showed that all the early treatments reduced the thrips population, keeping it far below the levels in untreated plots for at least ten days. The average increases in yield of seed cotton per acre over comparable untreated plots during the three years were 311 lb. for one early application only, 273 lb. for 2–3 late applications only and 584 lb. for one early application followed by 2–3 late ones.

DEBACH (P.). *Thysanus flavopalliatus* (**Ashm.**) **parasitic on** *Comperiella bifasciata* **How. in California Red Scale.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1112, 3 refs. Menasha, Wis., 1954.

Adults of *Thysanus flavopalliatus* (Ashm.) were collected in California in November 1952 on lemon fruits heavily infested by *Aonidiella aurantii*

(Mask.), and full-fed larvae and pupae of the same species were dissected and adults emerged from mummified examples of the Coccid in the insectary. As the Chinese strain of *Comperiella bifasciata* How. [*cf. R.A.E.*, A **39** 182] was also present as an internal parasite of the scale, it was not known whether *Thysanus* was a primary or a secondary parasite. When adults that emerged from the field-collected material were put with laboratory-reared examples of *A. aurantii* containing *Comperiella* larvae and pupae, *Thysanus* larvae were dissected from the scales as external parasites on *Comperiella* pupae, and adults of *Thysanus* emerged after 31 days at 75–80°F., whereas no evidence of parasitism was found in unparasitised *Aonidiella* exposed to *Thysanus*.

Griffith (R. D.) & Wene (G. P.). **Mite Injury to Sorghum in the Lower Rio Grande Valley of Texas.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1112–1113, 1 fig. Menasha, Wis., 1954.

Sorghum was damaged by *Paratetranychus pratensis* (Banks) in Texas in June 1953, and the mite was found to be distributed throughout the entire Lower Rio Grande Valley. It was injurious in fields on dry lands and present but not injurious in irrigated fields. Feeding by the mites caused the leaves to dry prematurely, resulting in a reduction in yield, and sometimes killed the plants before the seed heads developed. Heavy infestations can be detected by the webs, which usually occur on the undersides of the leaves or on the sorghum heads.

Dusting with 15 lb. 1 per cent. parathion or 35 lb. sulphur per acre resulted after two days in averages of 34·2 and 0·3 mites per square inch on the undersides of the lower leaves, as compared with 28·9 for no treatment, and it is concluded that sulphur affords good control.

Gaddis (C. H.). **Toxicity of various Fumigants to Sweetpotato Weevils and their Effect on Sweetpotatoes.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1113–1114. Menasha, Wis., 1954.

For several years, sweet-potato tubers grown in parts of the southern United States that are infested by the sweet-potato weevil [*Cylas formicarius elegantulus* (Summers)] have been fumigated with 3·5 lb. methyl bromide per 1,000 cu. ft. for five hours at a pulp temperature of 70°F. before being moved to uninfested areas. This gives good control of the weevil but it sometimes injures uncured or damaged tubers and the temperature is difficult to attain in winter; the fumigation is less effective and more injurious at lower temperatures. In attempts to find a more satisfactory fumigant [*cf. R.A.E.*, A **32** 121], methyl bromide used at 3·5 lb. per 1,000 cu. ft. for four hours, propylene oxide at 19 lb. for 24 hours and mixtures of ethylene dibromide, ethylene dichloride and carbon tetrachloride (20·4 : 19·6 : 60), carbon bisulphide and carbon tetrachloride (16·5 : 83·5) and ethylene dichloride and carbon tetrachloride (70·2 : 29·8) at 21, 36 and 42 lb., respectively, for eight hours gave complete kills of the weevil, whereas ethylene chlorobromide at 5 lb. for 24 hours and ethylene dibromide at 5·5 lb. for four hours gave only 76 and 33 per cent. mortality. Propylene oxide and the mixture of ethylene dichloride and carbon tetrachloride injured all the tubers seriously, methyl bromide, ethylene dibromide and the mixture of carbon bisulphide and carbon tetrachloride injured 8, 20 and 25 per cent. slightly and none seriously, and the other mixture injured 5 per cent. slightly and 5 per cent. seriously.

It is concluded that methyl bromide is better suited for treating sweet potatoes than any of the other fumigants tested; it is rapid in action, and though fumigants that act slowly would not be objectionable for the treatment of seed stock, they would be impractical for treating sweet potatoes that were to be moved commercially.

Dietrick (E. J.) & van den Bosch (R.). **Further Notes on *Hypera brunneipennis* and its Parasite, *Bathyplectes curculionis*.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1114, 2 refs. Menasha, Wis., 1954.

In an attempt to introduce the Ichneumonid, *Bathyplectes curculionis* (Thoms.), from San Diego county to the Imperial Valley of California for the control of *Hypera brunneipennis* (Boh.) on lucerne [*cf. R.A.E.*, A **41** 277], some 1,200 adult parasites and parasitised larvae were released in each of two plots in February and March 1953. Parasitised *Hypera* larvae were collected from one of these on 1st May, but none was found in the other plot or elsewhere in the valley in 1953. Surveys in the coastal area showed that the parasite was much more widely distributed in San Diego county in 1953 than in 1952. *Bathyplectes* was also recovered in April from 25·3 per cent. of the larvae of *H. brunneipennis* collected on lucerne at a place on the Arizona border, across the Colorado River from Yuma, and these individuals probably originated from the releases made in 1941, which were earlier thought to have failed [*cf.* **36** 55].

No parasites were reared from larvae of *H. brunneipennis* on *Trifolium alexandrinum* in northern Egypt in March 1953, and no adult *Bathyplectes* were observed in the field, so that there is reason to doubt whether this is the native habitat of the weevil [*cf.* **28** 120; **29** 629].

Dobrovsky (T. M.). **Another Wireworm of Irish Potatoes.**—*J. econ. Ent.* **46** (1953) no. 6 p. 1115, 3 refs. Menasha, Wis., 1954.

A survey between March 1952 and May 1953 showed that *Conoderus vagus* (Cand.), which was described from Argentina and is now known to occur in the United States in North and South Carolina, Georgia, northern Florida, Mississippi and Alabama, is the most important of the wireworms that injure potato in the Hastings area of Florida. Almost all the Elaterid adults and larvae collected in potato fields were of that species, and newly hatched larvae fed freely on the tubers in the laboratory, although they did not complete development on potatoes alone. Of seven full-fed larvae taken from their burrows in potato tubers in the field, five completed their development on potato in the laboratory.

Long (W. H.) & Dogger (J. R.). **The Elongate Flea Beetle as a Pest of Peanuts.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1115–1116, 4 refs. Menasha, Wis., 1954.

Diabrotica undecimpunctata howardi Barber is one of the most important subterranean pests of groundnuts in south-eastern Virginia and north-eastern North Carolina, but some of the injury attributed to it may have been caused by *Systena elongata* (F.), which occurs throughout North Carolina. The adults of this flea-beetle are active from February until November, and examination of soil samples at about 10-day intervals from 30th July to 18th September 1953 showed that larvae and pupae were present round the plants from about 30th July to 8th September and from

7th August to 18th September, respectively. The larvae were most numerous from about 7th to 27th August, and it seems probable that oviposition reaches its maximum about mid-July. The first adults of this generation were observed in the field on 18th August, and the numbers increased steadily until 17th September, when they were very high.

In the laboratory, larvae and pupae collected in the field between 8th August and 7th September gave rise to adults between 21st August and 16th September. The injury caused by the larvae of *Systena* was very similar to that due to *Diabrotica*, the larvae boring into the pods and feeding on the succulent inner tissues and the developing kernels. *Diabrotica* caused some damage from the time of formation of the first pods to harvest, but was most injurious in August and September, whereas damage by *Systena* occurred mainly in August and was the more important during the early part of the month.

Sherrer (J. D.) & Arant (F. S.). **Effect of certain systemic Compounds on Southern Red Mite infesting Camellias.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1116–1117, 2 refs. Menasha, Wis., 1954.

Paratetranychus ilicis (McG.) is a major pest of camellias and azaleas in Alabama, and in preliminary experiments in 1953, emulsion concentrates of the systemic poisons, schradan, diethyl (ethylmercapto)ethyl thiophosphate [demeton] and an analogue of this, dimethyl (ethylmercapto)ethyl thiophosphate (21/116), were applied in sprays to the soil round potted camellia plants for its control. Schradan was applied at rates equivalent to 2–12 lb. per acre and demeton and its analogue at 1–11 lb., and counts of mites were made on the plants before treatment and at weekly intervals for four weeks after it. Dosage-mortality curves showed that the median lethal dosages of demeton and its analogue were 2·2 and 0·6 lb. per acre; both killed more than 90 per cent. of the mites in a week at the higher rates, and both were still effective four weeks after application. Schradan was slower in action and gave results too erratic to permit calculation of the median lethal dosage; it was most effective four weeks after application, when it gave 80 per cent. mortality or more in most cases.

Rodriguez (J. G.). **Control of Tipulidae Larvae** (*Tipula cunctans* **Say**).—*J. econ. Ent.* **46** (1953) no. 6 pp. 1119–1120, 1 fig., 4 refs. Menasha, Wis., 1954.

Large numbers of larvae of *Tipula cunctans* Say occurred in Kentucky in the early spring of 1953 in old *Lespedeza* fields, in some of which spring oats had been sown. The organic matter from the previous season formed a thin rotting mat on the surface of the ground, and the larvae apparently fed on this, virtually destroying germinating *Lespedeza* or oats by tunnelling in and churning the top two inches of soil, and also on the germinating *Lespedeza* itself.

In tests in which plots that contained 85–100 larvae per square foot in the top two inches of soil received 50 U.S. gals. spray per acre on 27th March, treatment with 2 lb. toxaphene, 0·3 lb. BHC, 3 lb. DDT or 2 lb. chlordane per acre resulted in 7, 65, 46 and 64 per cent. mortality after three days, and treatment with 0·225 and 0·45 lb. parathion per acre in 86 and 98 per cent.; the toxaphene spray was prepared from an emulsion concentrate, and the others from wettable powders. Subsequent commercial treatment of fields with 0·3 lb. parathion per acre in low-gallonage sprays

gave excellent control within 48 hours. It was evident that effectiveness depended on the amount of spray used per acre, since the organic débris on the ground had to be penetrated for good control; 10–50 U.S. gals. proved satisfactory.

JENSEN (D. D.). **Longevity of the Leafhoppers** *Colladonus geminatus* (**Van Duzee**) **and** *Colladonus montanus* (**Van Duzee**) **on Peach.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1120–1121, 6 refs. Menasha, Wis., 1954.

Colladonus geminatus (Van D.) has been shown to be a vector of the viruses that cause western X-disease of stone fruits [*cf. R.A.E.*, A **39** 399], yellow leaf-roll of peach [*cf.* **40** 243] and aster yellows [*cf.* **39** 446], and the closely related *C. montanus* (Van D.) also transmits aster yellows [*cf.* **39** 446]. Both Jassids are widely distributed throughout the western United States, but *C. geminatus* is the commoner in the Pacific Northwest and *C. montanus* in the Sacramento Valley of California. Both have a wide range of food-plants.

As it was considered possible that *C. montanus* might be a vector of yellow leaf-roll of peach in California, comparative tests with the two species were carried out. These showed a striking contrast in ability to survive on that tree. The insects were reared on celery until many of the nymphs were in the last instar, and nymphs were transferred to diseased peach trees and allowed to feed for two days and then returned to celery and left for 18 days, after which males and females of each species were put singly on seedling peach trees, and, in some cases, transferred to fresh ones each day. Adults of *C. montanus* survived for only a few days on peach, whereas *C. geminatus* survived for up to 128 days, demonstrating that transference to peach had no deleterious effects on that species. Females of both Jassids tended to survive longer than males. When *C. montanus* was fed alternately for 2–4 days on peach and celery, the adults oviposited readily on leaves of diseased peach, large numbers of eggs hatched and the nymphs survived for several weeks, with little mortality during the early instars, but did not transform to adults.

WALL jr. (W. J.). **Damage to Carpet Materials by Silverfish.**—*J. econ. Ent.* **46** (1953) no. 6 pp. 1121–1122, 2 refs. Menasha, Wis., 1954.

To determine whether carpet materials would be attacked by *Ctenolepisma quadriseriata* (Pack.), groups of ten adults were confined with fibres of pure undyed carpet-type viscose rayon, wool or cellulose acetate and no other food for two months, after which about 60 mg., 15 mg. and none, respectively, had been consumed by the insects. When similar groups were provided with pieces of dyed and woven carpet, each about 20 × 5 mm. in size, with no other food or with whole wheat in addition, none of the cellulose acetate and about two-thirds of the viscose rayon was eaten in two months. Woollen carpet was slightly eaten in the absence of other food, but not in the presence of the wheat.

When *Thermobia domestica* (Pack.) was supplied with similar pieces of carpet, alone or with whole wheat flour, the results were similar to those with *C. quadriseriata*, and it is concluded that viscose rayon is particularly attractive to these two species, the attractive ingredient being the rayon itself and not the dye, cellulose acetate completely unattractive, and wool unattractive in the presence of other food. No evidence was found to show that the dye in the three materials was attractive to either insect.

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